THE

# ELECTRICAL REVIEW.

VOL. LIX. JULY 13, 1906. No. 1,494.

## ELECTRICAL REVIEW.

Vol. LIX.] CONTENTS: July 13, 1906. [No. 1,494.

| | Page |
|---|---|
| A Telephone Derelict in Port | 41 |
| The Electrical Engineers' Tour | 42 |
| Electric Traction Progress on the Lancashire and Yorkshire Railway (*illus.*) (*concluded*) | 43 |
| Gas and Electricity | 44 |
| A New Zinc-Lead Accumulator | 45 |
| I.E.E.—Visit of Kindred Institutions from Abroad | 47 |
| Correspondence | 48 |
| Developments in the Bastian Mercury Vapour Lamp (*illus.*) | 51 |
| Parliamentary | 52 |
| Legal | 53 |
| Business Notes | 55 |
| City Notes | 66 |
| Market Quotations | 68 |
| Stocks and Shares | 68 |
| Share List of Electrical Companies | 69 |
| Reviews | 71 |
| Proceedings of Institutions:— | |
| A New Single-Phase Commutator Motor. — Discussion (*illus.*) | 71 |
| The Incorporated Municipal Electrical Association:— | |
| Relative Economies of Electrical Supply from Small Local Stations, and from Power Companies | 74 |
| Rapid Methods for Producing Electrotypes (*illus.*) (*concluded*) | 75 |
| Interference in Wireless Telegraphy and the International Telegraph Conference (*illus.*) (*continued*) | 77 |
| Electrical Engineering and Railway Laboratories at Worcester Polytechnic Institute (*illus.*) | 79 |
| New Patents Applied For | 80 |
| Published Specifications | 80 |

THE ELECTRICAL REVIEW.

**Published every FRIDAY, Price 4d.**

*The Oldest Weekly Electrical Paper. Established* 1872.

TO BE OBTAINED BY ORDER FROM ANY NEWSAGENT IN TOWN OR COUNTRY.

***OFFICE:—4, LUDGATE HILL, LONDON, E.C.***

Telegraphic Address: "AGEEKAY, LONDON." Code, A B C.
Telephone No. 933 Holborn; 4425 Central.

*ALL Letters should be addressed to the Proprietors, H. Alabaster, Gatehouse & Co*

ADVERTISEMENT RATES ON APPLICATION.

**The "Electrical Review" is the recognised medium of the Electrical Trades,**
AND HAS
***BY FAR THE LARGEST CIRCULATION***
**of any Electrical Industrial Paper in Great Britain.**

*SUBSCRIPTION RATES.*—In Great Britain, Post Free, per Year, 19s. 6d. To all other countries, per Year, £1 10s.

*BINDING.*—Subscribers' numbers bound, including case, for 4s. each volume.

*CASES.*—Cloth Cases for Binding can be had, price 2s. 6d. each; post free 2s. 9d.

*READING CASES*, to hold from One to Twenty-six Numbers until the volume is complete for Binding, can be had from the Publishers, Price 6s., or Free by Post (in Great Britain), 6s. 6d.

*FOREIGN AGENTS.*—New York: D. VAN NOSTRAND, 23, Murray Street. Paris: VEUVE J. BOYVEAU, 22, Rue de la Banque. Berlin: ASHER & Co., 13 Unter den Linden.

Cheques and Postal Orders (on Chief Office, London), to be made payable to Mr H. ALABASTER, 4, Ludgate Hill, E.C.

THE

UNIVERSAL ELECTRICAL DIRECTORY

1906 Edition

NOW READY.

H. ALABASTER, GATEHOUSE & CO.,

4, Ludgate Hill, London, E.C.

## A TELEPHONE DERELICT IN PORT.

No reader who has followed the short history of the abortive municipal telephone undertaking at Glasgow can have been surprised at the decision of the Glasgow Town Council to sell out to the Post Office. Notwithstanding all the clamour made by the municipal enthusiasts, all the talk about cheap and efficient service, all the ingeniously arranged figures in the accounts and statistics, it has been evident for a long time past that the Glasgow telephone venture has proved an ignominious failure. In the competition with the National Telephone Co., the Corporation telephone system was beaten to a standstill two years ago, and it has for some time past been looked upon by Glasgow business men merely as a standby, so completely has it been overshadowed and enveloped by the system of its more progressive and alert commercial rival. This result was entirely unexpected by the Glasgow Councillors. In fact, the expectations were all the other way, and Glasgow started in the telephone business with the confident hope of extinguishing the service of the National Co. and of establishing another municipal monopoly. It is a bright feather in the cap of private enterprise that a great and wealthy Corporation, with all the local influence that a big trading Corporation possesses, should have been so signally defeated in such a short time. That the Glasgow Corporation would sell their telephone system if they saw the least hope of working it at a profit, or of maintaining their ground in the competition, is not to be imagined for a moment. The sale means that the Corporation realise that the position is hopeless, and are glad of the opportunity of retiring—without the honours of war.

While it is true that the active and well-managed competition of the National Telephone Co. has completely checked the progress of the Corporation system, it is also true, as has often been pointed out, that the Corporation undertaking was unsound from the very start, and was foredoomed to failure. The estimates and plans were erratic and fallacious in the extreme, the rates adopted were unremunerative, and the plant employed was obsolete and inferior. After a year or two of the glorious occupation of spending money like water, these fundamental defects began to tell; the capital expenditure soon reached, in proportion to results, double the estimated figure, the relations between working expenses and revenue rapidly became strained, and the inefficiency of the plant was demonstrated so quickly that within two years after starting the service, the Committee, in answer to general complaints of bad service, stated officially that a general change of system was contemplated—a change that has never been made. Since these troubles began to make themselves acutely felt, that is, from about three years ago, when the cranky vessel got fairly into deep water, the Glasgow telephone venture has been kept

afloat as best it could until friendly assistance should arrive to tow it into port.

That assistance has now come from a Liberal Government. The price given is a generous one, considering the notoriously inefficient character of the plant and the unprofitable nature of the business, and involves the Glasgow Corporation in a relatively small loss. No secret is made of the fact that the figure has been arrived at by dint of political pressure on the Government Departments concerned, and that it is considerably in excess of the Postmaster-General's original offer. This, however, is a minor point. It should not be necessary for the Glasgow Corporation to be convicted of throwing away £150,000 (which is nearer the real loss than £15,000) on an unsound experiment, in order to convince municipal traders that it is unwise to take up and conduct scientific businesses in a wholly unscientific manner. It was truly a poetic touch that last week the Glasgow Town Council, with the usual impatience of discussion which marks telephone debates in the Glasgow Council Chamber, should straightway proceed from voting the sale of the telephone system to ratifying the acquisition of a municipal sheep farm somewhere in the wilds of Scotland!

## THE ELECTRICAL ENGINEERS' TOUR.

On Saturday last the visit of our friends from abroad came to an end, after a delightful day in one of Britain's fairest regions; the weather was fortunately most propitious, and the last excursion was in many respects one of the most enjoyable of all. The occasion was unique: never before, we imagine, were the peaceful precincts of Fountains Abbey and the beautiful estate of Studley Royal invaded by a throng of electrical engineers, drawn from six great nations, and engaged in a profession of which the very name dates but from yesterday. Could they have risen from their long rest, what would the monkish builders have thought of their twentieth-century visitors?

Thus happily ended, as it began, one of the most successful tours that ever was organised. It is most gratifying to record that the arrangements made by the Institution of Electrical Engineers for the entertainment of their guests, and the admirable organisation of every detail for their comfort, fulfilled their purpose to a degree little short of perfection. Nothing seemed to have been overlooked. The accommodation provided in the special train of the L. & N.W. Railway Co. was such as to excite the admiration of the visitors: the arrangements for dealing with their luggage were so excellent that beyond packing and unpacking their portmanteaux the travellers were not called upon to concern themselves about it for a moment, and not a single instance came to our knowledge of luggage being delayed or going astray; the preparations made by the local sections for the reception of their guests were unexceptionable, and the hotel accommodation was in almost every case of first class order. Letters were delivered with the minimum of delay, and even collected on the train for dispatch. Nothing could be suggested in the way of improvement, and our efforts to ascertain whether any complaints were forthcoming resulted satisfactorily in complete failure. As Mr. Lieb said at Edinburgh, the Institution is to be congratulated on having broken all records.

The hearty co-operation of the Local Sections contributed in the highest degree to this happy result; without their aid it would have been impossible. The cordial assistance of the local municipal authorities was also an indispensable factor in adding *éclat* to the tour and endowing it with an international character of friendship and goodwill. It is true that the receptions became somewhat frequent and perhaps a little monotonous, but we believe that our guests on the whole enjoyed them, and certainly they were thereby enabled to gain a more thorough insight into the manners and customs of our civic life than would otherwise have been possible. Work and play were admirably intermingled, and, as was pointed out to us by one of them, not only were the visitors conducted through numerous works and factories, but also they were shown several of the choicest examples of our rural scenery, so that they carry away with them a comprehensive memory of woodland, field, lake and mountain, together with the less picturesque and more strenuous impressions of our industrial districts.

The fact that Great Britain is a huge workshop seems to have struck some of the visitors with the force of an altogether new idea. As regards the technical standing of the works inspected, it is pleasing to learn that while in some respects we are backward, thanks mainly to the conditions which hamper and restrict enterprise in this country, in other particulars we are abreast or even ahead of the latest practice prevailing in other countries. Naturally, the visitors evinced keen interest in the manufacture and running of turbine machinery, which originated in this country, and in which we lead the world; we doubt, however, whether they fully appreciated the merits of the high-speed reciprocating plant which has been here developed to so high a pitch of excellence, for a 1,500-kw. high-speed set looks but a small affair when compared with a generating set of the same output running at 90 r.p.m. Some of the engineering laboratories inspected were greatly admired, though the methods in vogue therein did not escape criticism. The low prices of energy were a revelation to some, who were accustomed to look upon steam plant as more costly to run than hydraulic plant; we found that some of our steam stations were supplying energy at prices which compared not unfavourably with the best results obtainable from water-power abroad. In a few years' time we may not improbably be able to point to such stations supplying at prices which cannot be attained with water-power plants. In conclusion, we repeat that the greatest credit is due to the organisers of the tour for their excellent work, and we would especially name Mr. Gavey, Mr. R. K. Gray, Prof. Cormack, Mr. Lloyd, Mr. Rowell, Mr. Tree, and the two Messrs. Langridge as deserving of the thanks of all who took part in it.

**Street Box Explosions.**

We published last week a full report of the case of Ogden *v.* Gas Light and Coke Co., where the liability of a gas company for the results of an explosion in one of their street boxes formed the subject of discussion. The case was originally tried before a jury (see Electrical Review, March 24th, 1905), when that tribunal found that the gas company were guilty of negligence. The Court of Appeal has refused to disturb this verdict. Lord Loreburn, in giving judgment, said: "There was evidence that gas in these boxes is seldom found to a dangerous degree, and there were statements that it can be prevented. The real point, to my mind, is that there was notice given to the company of the presence of gas, and ample opportunity for them to learn what others learned in the interval between August and October—that gas was present and discernible by a strong smell. It seems to me there was a duty upon the company to put an end to whatever created that smell, which indicated danger." It was also contended on the part of the appellants that the real and efficient cause of the accident was the use of a naked flame by a servant of the Post Office; but the Court of Appeal dismissed this contention by saying that if it had not been for the accumulated gas there could have been no explosion. Electric lighting companies should make a note of the decision in this case. If an explosion takes place in an ordinary street box, they are often met with a claim for damages. The above case, however, is an authority for the proposition that, although a short-circuit may have been the *causa proxima* of the explosion, the electric lighting company are not necessarily liable. At the same time, it would be a legitimate deduction from Ogden's case that if the plaintiff saw fit to sue an electric lighting company he might succeed in obtaining damages.

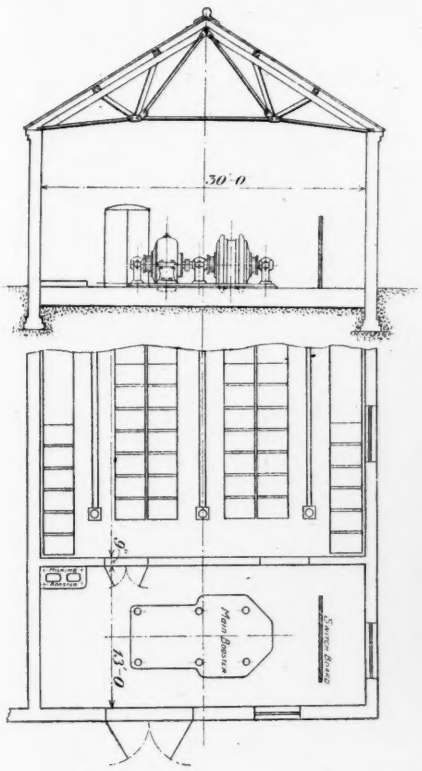
The Post Office is sheltered in these matters under the maxim "the King can do no wrong." This need of protection is not extended to a mere company working under a provisional order.

## ELECTRIC TRACTION PROGRESS ON THE LANCASHIRE AND YORKSHIRE RAILWAY.

(*Concluded from page* 5.)

Experience in dealing with the varying conditions of traffic has led the company to adopt trains consisting of two motor coaches and one, two or three trailers, the five-coach trains being worked during the rush hours of morning and evening. These trains weigh 118, 144 and 170 tons each, respectively. In addition to the above, a baggage car weighing 32 tons is in constant operation on the line, running conveniently between scheduled trains, and dealing with baggage, goods, produce, fish, &c., which cannot be handled during the 15 sec. station stops usual to the passenger trains.

The trains have been fully described in our previous article; the motor compartments are designed to be fireproof, uralite being largely employed for lining purposes.



Sectional Elevation and Plan of a Battery Sub-Station; also View of Tudor Battery, L. & Y. Railway.

The system of control adopted embraces most of the advantages of the multiple unit system, while dispensing with its numerous connections.

The motor-cars are single ended, a controller of the Dick, Kerr metallic shield blow-out type in the driving compartment deals with the energy for both motor-cars; the resistances on the leading motor-car serves for both of them, and only four train cables are necessary. The controller contains two inter-geared barrels, each of which operates the four 150-b.h.p. motors provided on either motor-coach.

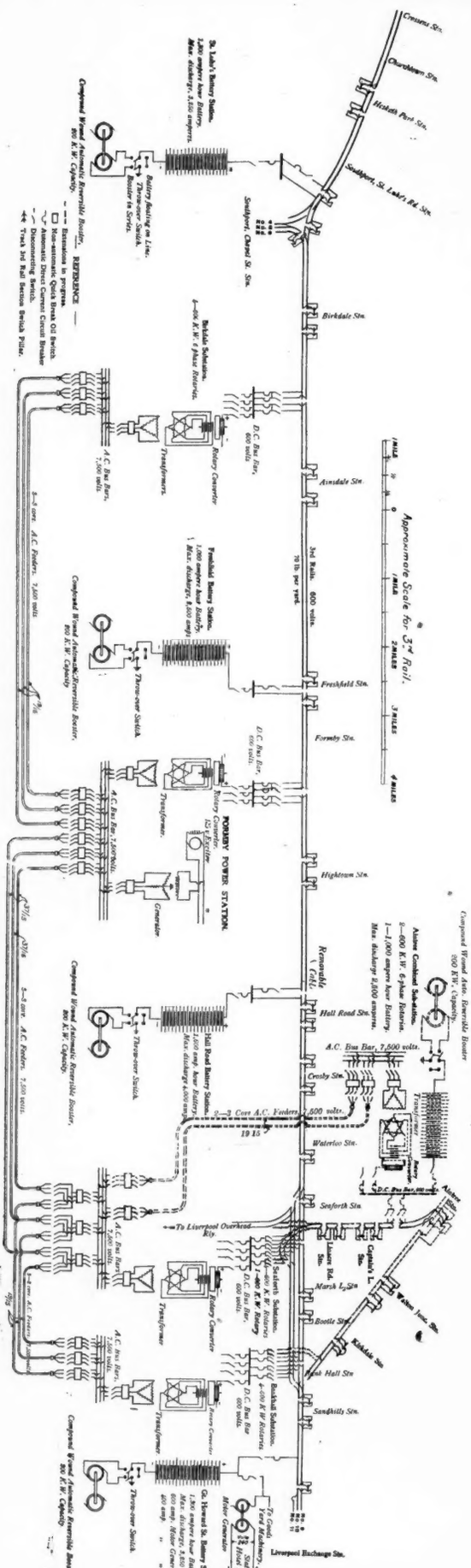
The watt-hours per ton-mile taken at the car for these runs average, within very fine limitations, 80. The expresses absorb only 53 watt-hours per ton-mile. The energy consumption per ton-mile over the whole system is 82·3, which is accounted for by the frequency of the Hall Road services and the station density at that end of the line. Interesting curves were given on p. 4 of last week's issue, indicating the energy required on an express train and giving readings taken on three, four and five-car trains.

The original scheme, which was described in detail in our pages, was originally laid down for working with 12 trains, but almost from the first, 15 have been found necessary, then a 10-minute service between the Liverpool Overhead and the Liverpool-Southport lines was established, and, later, a system of through trains between Southport and the Dingle, and these additions have naturally involved a heavier power-house output than was initially contemplated. Instead, however, of increasing the capacity of the power house to meet this demand, it was decided to put down a comprehensive system of storage batteries which should be capable of dealing with the severe peak loads inseparable from the electrical working of such a railway. The extensions which are being added now, and possibly further ones in contemplation, have, however, involved the necessity of extending the power house and sub-station plant.

The batteries were made by the Tudor Accumulator Co., and installed in four battery sub-stations, the points of erection being selected with a view to the feeding of the line at or near to its terminals, and at those positions in its length where the least influence of the rotary sub-stations was felt. The first accumulator sub-station was erected in the Great Howard Street goods yard, about a ¼ mile from the Exchange, and has a capacity of 1,300 amperes discharge for 1 hour, or a maximum output for a short period of 3,300 amperes. The next battery sub-station has been placed at Hall Road, a point roughly equidistant from the Seaforth and Formby rotary sub-stations, and where the heavy local Liverpool traffic turns back; it has an hourly discharge capacity of 1,600 amperes, and a maximum output of 4,000 amperes. The third battery, of 1,000-ampere-hour and 2,500 maximum ampere discharge, is at Freshfield, and the fourth is placed at St. Luke's, which is the first stop on the road to Crossens and beyond Southport. Each battery is controlled by a 200-kw. automatic reversible booster. By placing the batteries in these positions, relatively to the converting and rotary sub-stations, an equilibrium in load and in voltage is kept up over the whole line.

The possession of accumulators at Great Howard Street and the furnishing of the station with motor-generators, enables the company to conduct all the operations of the local goods yard by electric power, to do all the terminus and yard lighting, as well as provide the complete electric supply for power and light to the Exchange Hotel, which is one of the most commodious and one of the largest and most important in the North of England.

The electrification of the Walton Junction and the North Mersey branch necessitates the erection of another sub-station, which is to be located at Aintree, and will be provided with two rotary transformers, each of 600-kw. capacity, with necessary statics, &c., each unit being a duplicate of that originally installed in the earlier sub-stations. Housed in the same building will be a Tudor battery capable of giving a continuous output for one hour of 1,500 amperes, and this battery will be connected to the third-rail through




a 200-KW. reversible booster, in a manner similar to that which has been adopted at the other stations. The sub-station at Aintree will be connected by means of high tension cables with the rotary sub-station at Seaforth, as, owing to the ample section of the trunk mains from the power house to this point and the equalising of the load through accumulators, it will not be necessary to reinforce the main high tension cable system.

We gather that it is intended to install a 3,000-KW. turbo-alternator at the Formby power station in the near future ; a diagram showing the electrical connections of the system and the positions of the battery sub-stations is given herewith.

The following data are of interest in showing the working conditions of the plant :—

| | |
|---|---|
| Average number of trains in service ... ... ... | 12 |
| Maximum momentary current per train (amperes) ... | 2,400 |
| Average current per train at full speed (amperes) ... | 550 |
| Train miles per day ... ... ... ... ... ... | 3,400 |
| Kilowatt capacity of rotary converters on load in hour of maximum load ... ... ... ... ... ... | 5,400 |
| Kilowatt capacity of generators on load in hour of maximum load ... ... ... ... ... ... | 3,750 |
| Combined efficiency of H.T. cables and rotary converters | 85% |
| Average load during heaviest hour (kilowatts) ... ... | 3,500 |
| Average cos $\phi$ ... ... ... ... ... ... | ·95 |
| Maximum momentary load during heaviest hour (kilowatts) ... ... ... ... ... ... ... | 4,500 |
| Maximum momentary load during heaviest hour (kilowatts), without batteries... ... ... ... ... | 8,000 |
| Number of boilers in service ... ... ... ... | 10 to 12 |
| Average coal consumption in lb. per KW.-hour at power station ... ... ... ... ... ... ... | 3·0 to 3·5 |
| Calorific value of 1 lb. of coal in B.TH.U.... ... about | 13,000 |
| Maximum number of generators on load, two 1,500-KW. and one 750-KW. | |
| *Load factor ... ... ... ... ... ... ... | 75% |

$$\text{* Ratio} = \frac{\text{Actual output of station for any hour.}}{\text{Full load output of engines on load for that hour.}}$$

| | Tons. | Cwt. |
|---|---|---|
| Weight of one standard motor-car with four 150-H.P. motors (unloaded ... ... ... ... ... | 45 | 10 |
| Weight of one trailer-car complete ... ... ... | 26 | 2 |
| Weight of one 150-H.P. motor, complete with gear ... | 2 | 16 |
| Weight of one motor bogie with two 150-H.P. motors, complete with electrical equipment ... ... ... | 11 | 19 |
| Total weight of electrical equipment in car body of standard motor-cars ... ... ... ... ... | 3 | 0 |
| Weight of one contact shoe... ... ... ... ... | 64 lb. | |

From the various reports published in our columns from time to time, ample evidence is shown of the success which has attended the Lancashire and Yorkshire Railway Co.'s electrical scheme, for which Messrs. Dick, Kerr & Co. were the sole contractors, with the exception of the rolling stock.

The latter, it may be noted, consists of 38 standard motor-cars, a baggage car, 12 multiple unit motor-cars of smaller type, and 46 trailers.

## GAS AND ELECTRICITY.

BY A. J. ABRAHAM, A.M.I.E.E., Resident Engineer, Cambuslang.

IT has now become a too common thing to find in both large and small towns that shopkeepers and others are throwing over their electric light in favour of high-pressure gas. I have noticed in Glasgow and other neighbouring towns that electricity is being replaced by high candle-power gas "arc" lamps for shop lighting. In one case (Bow's Emporium, High Street, Glasgow) I have noticed that gas lights have replaced 10-ampere open-type arc lamps. At first these high candle-power gas lamps give a splendid light, but this, after a very short time, becomes sickly and yellow. It is to be noticed that they throw out a great heat. A shade is fitted over them, and, in consequence of this there is a beautiful black ring on the ceiling—that is to say, the ceiling does not become smoked directly over the shade, but all round it ! In spite of these disadvantages—*i.e.*, sickly yellow light, dirt, heat, unhealthy fumes, &c., they are, as I stated above, competing against electricity, in a too-successful manner. Wiring contractors by their delay in keeping up with the times are to be blamed for this state of affairs more than most people, and next to the wiring contractor, the supply authority.

It ought by this time to have become a recognised fact that the common carbon filament glow lamp ought to be, except in special cases, a thing of the past just as much as the flat flame gas burner is. Yet every new installation we see connected up is, with rare exceptions, fitted in the same old manner, with the same old wasteful dull carbon filament glow lamp, the same old three-light fittings placed in the same old positions. While we are jogging along, the gas people have done away with their flat flame burners and are running incandescent gas for all it is worth, and we sit still and wonder why, and the wiring contractors complain of slack business!

We all know that a contractor who quotes for economical lighting will have his prices "cut" by one quoting for the cheap and nasty carbon filament lamp, but there is nothing to hinder the former contractor from giving two quotations, and for him to point out that it is to the consumers' advantage to pay very much more for lamps using less than half the watts per C.P. The wiring contractor's business at the present time is not a gold mine, and he has only himself to blame for this. Shops are being wired in Glasgow for 8s. a light, and then the gasman comes in and fits up a 35s. high-pressure gas lamp "on approval," which always stops up, and no wonder!

Electricity supply works, again, do not advertise enough, or keep the public informed concerning the improvements and advantages of electricity. The gas works do all the advertising, and compare their latest gas lights with our old friend the carbon filament lamp. It would pay large supply works such as Glasgow, Edinburgh, Liverpool, &c., to publish a monthly electrical journal which would interest and keep the general public up-to-date, and well informed on electrical matters. Small works should send out circulars —a different one each month—for the same purpose. If wiring contractors and supply works would wake up, everybody would soon have the electric light.

I do not hold a brief for the tantalum, osmium, Nernst, arc or any other lamp-makers; but the Cambuslang side street public lighting will perhaps illustrate what could be done by go-ahead wiring contractors for private lighting. During last winter our side streets were lit by 440 carbon filament 16-C.P. incandescent lamps with the usual unsatisfactory result, to say nothing of a bad advertisement. At street corners tantalum lights were tried, with the result that the District Lighting Committee propose next winter to change over all the side street lighting to tantalum lamps. Assuming for a moment the useful life of a tantalum to be no more than that of an ordinary incandescent lamp, this is how the two different systems of lighting would compare :—

| Present system. | Proposed system. |
|---|---|
| 440 16-C.P. 60-watt glow lamps. | 440 25-C.P. 42·5-watt tantalum lamps. |
| Total candle-power, 7,040. | Total candle-power, 11,000. |
| Units consumed per 2,000 hours = 52,800. | Units consumed per 2,000 hours = 37,400. |
| Cost of electricity at 2d. = £440. | Cost of electricity at 2d. = £311. |
| Renewals, say 1,320 lamps at 8½d. = £46. | Renewals, say 1,320 lamps at 2s. 9d. = £181. |

Total cost of present system, 7,040 C.P., £486 per annum (16·5d. per candle-power).

Total cost of proposed system, 11,000 C.P., £492 per annum 10·7d. per candle-power).

As a matter of fact, the useful life of a tantalum lamp is until it burns out, and they are guaranteed for 1,000 hours. Taking this into consideration the following is a truer comparison :—

Total cost of present system, 7,040 C.P., £486 per annum, or 16·5d. per candle-power per year.

Total cost of proposed system, 11,000 C.P., £427 per annum, or 9·3d. per candle-power per year.

Or an extra 4,000 C.P. with an annual saving of £59.

I am not especially recommending tantalum lamps. As a matter of fact, from the tests I have made I consider the osmium to be a superior lamp except for the low voltage difficulty. The osmium lamp does not blacken, and is, if anything, slightly more economical.

What experience I have had with the Nernst lamp has been disappointing. The burners are a great trouble, or at least I have found them to be so. I also consider that the Nernst lamp has been spoiled by the general use of semi-opaque globes which—although their object is to diffuse—cut off more than half the light. As an instance of this, I might mention that in order to educate consumers of electricity in Cambuslang, I have fitted up both Nernst and tantalum lamps for them to try, explaining at the same time the saving in units which can be brought about by the use of such lamps. In no case as yet have I succeeded in getting a consumer to adopt Nernst lamps, although the tantalum lamp is spreading over Cambuslang. I have no doubt that had the tantalum been put into Nernst globes and the Nernst lamp supplied with clear globes, the result would have been the opposite. This shows, I think, that people like a bright showy light, and if they are made to understand the reason, they are quite willing to pay more for an efficient lamp. It also goes to show that wiring contractors do not take the trouble to keep their customers up-to-date or are ignorant of the importance of this, to themselves and the electrical industry generally.

Even in a small place like Cambuslang, the gas company take advantage of the everlasting carbon filament lamp, as the following will show :—

COMPARATIVE COST OF LIGHT—GAS *v.* ELECTRICITY.

| — | Consuming. | Candle power. | Costing. | Cost of 1,000 C.P. for 1 hour. |
|---|---|---|---|---|
| Incandescent inverted burner | 3 ft. per hour | 60 | 1d. for 10 hours | 1¾d. |
| Ordinary gas burner | 5 ft. per hour at 2s. 10d. per 1,000 ft. | 20 | 1d. for 6 hours | 8½d. |
| Electric light | 64 watts at 4d. per 1,000 watts, 1,000 watts equal 1 Board of Trade unit | 16 | 1d. for 4 hours | 15½d. |

I was rather astonished to learn for the first time that we sold electricity at "4d. per 1,000 watts," also that "1,000 watts equal 1 B. of T. unit!" It will also be noticed that the incandescent electric lamp mentioned takes 4 watts per candle power, and is evidently one of German manufacture.

## A NEW ZINC-LEAD ACCUMULATOR.

ALTHOUGH it is over 100 years since Ritter and Gautherot discovered the reversibility of the electrolytic action, we are still waiting for the battery which shall put accumulator traction on a really sound commercial basis. Whilst there are a good many electric vehicles now propelled by accumulators, we do not think the most sanguine electrical engineer is really satisfied, but is still looking for what has long been promised by inventors, viz., an accumulator which will do as much as any existing accumulator at about half the weight. It is recognised that very little advance is possible in this direction with a lead accumulator, and as long ago as 1884 Emil Reynier brought out an accumulator in which the elements were zinc and lead peroxide. It was at once seen that if a satisfactory cell could be developed on these lines, it would have a considerable advantage over the lead accumulator, in that it would give about 2·5 volts when fully charged, and the weight for a given output could be considerably reduced. Other inventors have worked since on the same lines, but with only partial success. One of the chief troubles appertaining to all batteries in which zinc is used is that of local action, and, in his original battery, Reynier attempted to minimise this by electro-depositing pure zinc on thin sheets of lead. In a Reynier cell consisting of three zinc and four peroxide plates, and having an output of 152 ampere-hours at a 25-ampere rate, the total weight of the plates was 21 lb. The output, therefore, works out to about 7¼ ampere-hours per lb., or, assuming an average voltage of 2·15 volts, to 15½ watt-hours per lb. of plate.

The chemistry of the zinc-lead accumulator is somewhat complex, but, generally speaking, the action is that in discharging, the zinc dissolves in the sulphuric acid, forming zinc sulphate; this is decomposed in recharging, the metallic zinc being deposited on the zinc plates. A stumbling block hitherto has been the difficulty in obtaining a good zinc deposit on recharging.

E

supply authority.



In the "Zedecco" battery, which is a new zinc and lead peroxide battery shortly to be placed on the English market, it is claimed that the difficulties formerly experienced with a zinc-lead accumulator have been satisfactorily surmounted.

A thin plate of amalgamated commercial zinc is used for the negative, and for the positive a special type of Faure plate is used. This plate consists of a lead grid filled with a paste composed of litharge prepared with a patent mixture (of which the proportions are not disclosed) such that when formed it produces a very porous plate, and one which apparently is free from buckling.

One of the special features of the cell is that during the charging process air is bubbled up between the plates from the bottom of the charging boxes, by means of perforated pipes connected to a compressed air receiver, thus keeping the liquid in constant motion and at the same time presenting streams of air to the charging surfaces of the plates. By this means a very smooth deposit of zinc is obtained on the plates. It is also claimed that by this means a higher oxide than $PbO_2$ is obtained. The plates are certainly much darker in appearance than ordinary peroxide plates, but we are unable to verify the claim as to higher oxidation.

When charged, the plates can be washed and dried, and kept for considerable periods without losing their charge, as there is no tendency for the peroxide to become reduced, and the zinc plate, of course, does not alter. In a trial run recently made on an electromobile fitted with these cells, the batteries had been charged and dried for a month before being placed on the car.

As at present constructed the plates are fitted in ebonite-lined aluminium boxes, three cells being fitted in one box.

In the cells used on the automobile test runs, 16 boxes or 48 cells were used, each box weighing 124 lb., or a total weight of approximately 17½ cwt.

The output claimed for the battery at the normal rate of discharge of 50 amperes, is 48 to 50 watt-hours per kg., and 39 watt-hours per kg. at a discharge rate of 150 amperes. It is to be noted that the output is given in terms of kilogrammes, and the above figures correspond with about 22 and 17½ watt-hours per lb. of cell.

We have paid several visits to the charging garage and carefully examined the details of the cells, and compared the charge and discharge charts of the recording voltmeter and ammeter. From these records we have abstracted the following data :—

*Abstract of Tests on Zedecco Cell, June 25th and 26th, 1906.*

One box of three cells discharged at—

89 amperes for 2½ hours = 222 ampere-hours, average volts 2·42 per cell.

65 amperes for 1½ hours = 98 ampere-hours, average volts 1·83 per cell.

Total ... ... 320 ampere-hours.

Same cells re-charged. Weight of a set of zinc plates (14 in number) on commencing charge = 3 lb. 3 oz.

Charging volts varied from 2·8 to 2·64 volts per cell, average 2·71.

Charging amperes varied from 55 amperes down to 15 amperes.

Time charging, 10 hours 20 minutes.

Total charge 424·61 ampere-hours at 2·71 = 1,150 watt-hours.

Weight of the 14 zinc plates at end of charge... 4 lb. 2 oz.

Weight of the 14 zinc plates at commencement of charge ... ... ... ... ... 3 lb. 3 oz.

Weight gained in charging ... ... ... 15 oz.

The theoretical weight deposited would be about 18 oz.

After the above charge the cells were discharged on a constant resistance with the following results :—

Started at 2·58 volts per cell at 50 amperes down to 1·8 volts at 35 amperes.

Total ampere-hours discharge = 399 ; watt-hours, 860.

After standing all night the cells recuperated, and gave in our presence 2·5 volts on open circuit, and 50 amperes, starting at 2·2 volts, for ¼ hour. One cell was, at our request, short-circuited for over one minute, and gave 120 amperes at 1·4 volts, and then quickly rose to 2·2 on open circuit.

Weight of complete cell, 42 lb.

This gives for 860 watt-hours over 20 watt-hours per lb. per cell, and about 36 watt-hours per lb. of plates.

It would, of course, be very misleading to base any data as to watt-hours per lb., or efficiency in ampere-hours or watt-hours on one charge and discharge. This is quite obvious from the above figures, as, if we add to the 399 ampere-hours' discharge the short discharge after recuperation, we reach an ampere-hour efficiency of about 97·5 per cent., and this could be exceeded by taking further short discharges after again recuperating.

We should like to see the average figures over a number, say, at the least, 10 charges and discharges.

For the purpose of comparison, the outputs of various storage batteries as given by the manufacturers will be interesting.

The following figures are taken from Mr. H. F. Joel's paper, read before the Institution of Civil Engineers, 1903 :—

| Battery. | Watt-hours per lb. of complete cell. | E.M.F. of discharge. Volts. |
|---|---|---|
| Faure-Sellon-Volckmar ... ... ... | 9·0 | 2·0 |
| Fulmen ... ... ... ... ... | 11·0 | 2·0 |
| B.G.S. modified Fulmen ... ... ... | 12·65 | 2·0 |
| E.P.S. Faure-King ... ... ... ... | 8·0 | 2·0 |
| Rosenthal "National" cell ... ... | 15·0 | 2·0 |
| Lee-Coll (lead and zinc with cadmium) ... | 10·6 | 2·5 |

It will be noted that in no case is anything like 20 watt-hours per lb. reached, as claimed for the Zedecco cell, so that if this figure can be maintained, it will mark a distinct step in advance of what has hitherto been accomplished with automobile cells.

As to the mileage that has hitherto been made on electromobiles fitted with accumulators, the following data from the same source as above may, we think, be considered authentic :—

| Date. | Name. | Weight of car loaded. | Total miles run. | Speed in miles per hour. |
|---|---|---|---|---|
| Nov. 17th, 1899 | "Columbia" runabout | 1·16 ton | 100 | 13·3 |
| May 14th, 1900 | "Criterium" car | 2·5 tons | 162·5 | 10 |
| Oct. 18th, 1900 | "Joel" car voiturette | 1 ton | 53 | 10 |
| June, 1901 ... | "Powerful" touring car | 2·2 tons | 94·75 | 11·5 |
| Sept., 1901 ... | Baker runabout | 0·61 ton | 187·5 | 8 |
| October, 1901 | Kriéger car | 2·45 tons | 190·3 | 12·4 |

The car used for the trial runs with the Zedecco accumulator was an ordinary Sheele chassis fitted with two 5-H.P. motors and series-parallel control. The cells were fitted in two groups and covered with box seats. The total weight of the car when loaded with six passengers, including driver, was 2·1 tons.

Several runs have been made with this car fitted with 48 cells as mentioned above, the runs on one charge varying from 75 miles to 120 miles, the routes, we understand, being to Brighton, Reading and Newbury and back. The speed on the level was 20 miles an hour, the average speed throughout being limited by the amount of traffic met with.

The trial runs have been attended by the following technical experts :—Messrs. T. Parker, jun., H. M. Sayers, J. Hewett, Leonard Tate and Frank Broadbent, and we shall be interested in seeing the reports of these gentlemen as to the behaviour of the battery during these runs.

As at present constructed, we should say, if we may do so without any risk of weakening the bonds of *l'entente cordiale*, that the battery is a little too Frenchy, and that the parts will need considerably strengthening mechanically in order to deal satisfactorily with electromobile work.

The special charging arrangements and also the somewhat comparatively long period required for charging will militate against the use of the battery for touring purposes, and we understand that it is the intention of the company to limit its use to town work where these disadvantages will not be felt, as each car will be provided with duplicate batteries, one of which will be charging whilst the other is in use.

We should welcome any battery which advanced the cause of electromobile traction, and if the Zedecco battery will do regularly in practice what is claimed for it by the promoters, there is, we think, no doubt that a step in advance will have been made.

## THE INSTITUTION OF ELECTRICAL ENGINEERS.

VISIT OF KINDRED INSTITUTIONS FROM ABROAD.

(*Continued from page* 11.)

ON Monday morning, while the lady engineers were taken for a drive round Glasgow, most of the males proceeded to the power stations of the Corporation at Pinkston and Port Dundas. The former, which was built in 1900 for the supply of power to the electric tramways, and commenced operation in 1901, contains four main three-phase generating sets—two Allis-B.T.-H. and two Musgrave-B.T.-H.—of 4,000 H.P. each, two Stewart-B.T.-H. D.C. sets of 800 H.P. each, and six Allen-B.T.-H. auxiliary sets of 100 H.P. each, making a total of over 18,000 H.P.; the plant in the main is the same as when we fully described it in August and September, 1901, but important changes have been made in the switchgear. This was originally of the air-break type, but it gave a good deal of trouble, and in 1904 it was entirely replaced (so far as the 6,500-volt generators and feeders were concerned) by oil-break switches electrically operated from a control board on the gallery in the engine room. The change has involved considerable structural alterations, and has extended also to some of the sub-station switchgear. The other generating station visited, at Port Dundas, is one of the two belonging to the Electricity Supply Department, and contains plant of 20,000 H.P., including Willans-Dick, Kerr turbo-alternators of 9,000-H.P. output. It is interesting to note that while the building (of which one wing remains to be erected) was designed to accommodate 30,000 H.P. of reciprocating engine plant, the adoption of turbine engines enables more than this amount to be installed in the present buildings, and the whole building will be able to contain plant of over 60,000 H.P. when completed. Both types of plant as installed at Port Dundas have been fully described in our pages. The visitors were taken round by the city electrical engineer, Mr. W. W. Lackie, and his assistants.

Returning from the works, the party reassembled at the City Chambers, where the visitors were formally received by the Lord Provost and other municipal dignitaries and entertained at luncheon by the Tramways and Electricity Committees of the Corporation. The meal ended, the Lord Provost welcomed the visitors in the name of the city, and Mr. Hugh Alexander, Convener of the Tramways Committee, proposed the health of the I.E.E., Lord Kelvin's name being enthusiastically acclaimed. The president, Mr. J. Gavey, responded, and incidentally drew attention to the vast progress which he had seen take place in electrical science during his career; from performing the function of "nerves," electricity had come to fulfilling the duty of muscles, displacing, for instance, steam on some railways, &c. Mr. J. Willock proposed "The Kindred Institutions," and Signor Semenza, in his reply, reminded his hearers that an International Exhibition was in progress at Milan, and that a congress would take place there in October. Herr E. Nagio also acknowledged the toast. Lord Kelvin, who was received with cheers, proposing "The Corporation of Glasgow," remarked upon the advances made in wireless telegraphy, and advocated a universal alliance for peace and friendship, to which electricity would contribute no small share. The Lord Provost responded, and commented upon the fact that, as Glasgow had James Watt nearly a century ago, to whom the steam engine was so greatly indebted, so now it had Lord Kelvin, the leader in electricity, as Chancellor of the University. Lord Kingsburgh proposed "The Ladies," remarking that they had practised wireless telegraphy for years past, and Mrs. Bilsland acknowledged the toast, after which the proceedings terminated with "Auld Lang Syne," sung with linked hands, a performance which greatly delighted the visitors.

In the afternoon the programme offered no fewer than seven alternatives. Besides a trip to Rouken Glen (for the ladies), and one through the principal streets of Glasgow, arrangements were made for visits to the Yoker power station of the Clyde Valley Electrical Power Co. and Messrs. John Brown and Co.'s Clydebank shipyard; to the Dalmuir shipyard of Messrs. W. Beardmore & Co., Ltd., or the works of Messrs. Singer's Manufacturing Co., Ltd.; to the Hyde Park works of the North British Locomotive Co., Ltd; to the works of the Fairfield Shipbuilding and Engineering Co., Ltd.; and to the Parkhead works of Messrs. W. Beardmore and Co. Amid so many enticing possibilities, it was exceedingly difficult to choose. Many went to the shipyards; we elected to visit the Parkhead Forge, and had no reason to regret our decision. On the contrary, the visit proved most instructive and entertaining; escorted by Mr. Ross, the general manager, the party visited various rolling mills for plates and bars; a mill engaged in the manufacture of steel tires for railway wheels by expanding and rolling from the solid; the fluid compressed steel department, where the Harmet process is employed to produce sound ingots with the minimum of scrap; the gas-driven electric plant; and some of the hydraulic forging presses, machine shops, &c. The power station was by no means the least interesting of these items; the Mond gas system was in use, with recovery plant, and we were informed that the sale of the sulphate of ammonia not only covered the cost of fuel, but left a fair balance on the right side. The gas engines at Parkhead, aggregating several thousand horse-power, were of the Koerting type, coupled to electric generators; those at Dalmuir shipyard, however, are of the Oechelhaeuser type, of which Messrs. Beardmore are the makers in this country. So successful has the gas plant proved that large extensions are in hand. Most of Messrs. Beardmore's work consists in the manufacture of specialities, as distinguished from standard sections, &c., and includes the manufacture of armour plate, gun tubes and other heavy work, for some of which purposes important building extensions are in progress.

One of the chief features of the Fairfield works was the extensive system of electric driving in use, with steam-driven generating plant of about 2,500 H.P. The general supply is at 220 volts D.C., but one of the generators is provided with slip-rings and balancing coils to feed a three-wire system at 110 volts for the temporary lighting of ships under construction. Electric power is used for driving tools, hydraulic pumps, winches, portable machines and an electric locomotive, the last-named taking power from the Corporation trolley system.

The Singer Co's works at Kilbowie employ 10,000 hands, and turn out 21,000 sewing machines per week. The enormous variety of parts manufactured in the works can hardly be imagined, and even when we visited the works many years ago the factory was a model of organisation and activity.

The Yoker power station of the Clyde Valley Co., which at present contains Westinghouse-Parsons generating plant of 4,000 KW. at 11,000 volts, three-phase, 25 cycles per second, was described in our issue of June 23rd, 1905. The switchgear is of the remote electrical control type. A similar station has been installed at Motherwell.

On Monday evening a reception was held at the University by the Rt. Hon. Lord Kelvin, Chancellor of the University, accompanied by Lady Kelvin, the Lord Provost (Mr. W. Bilsland) and Mrs. Bilsland. During the evening Signor G. Semenza, on behalf of the Italian visitors, presented Lord Kelvin (who was recently elected an honorary member of the Italian Electro-technical Association) with two portfolios of drawings by the great Italian artist-engineer, Leonardo da Vinci, in token of their esteem. Prof. Pagliani read an address from the University of Palermo, and Lord Kelvin, who was much moved, expressed his heartfelt appreciation of their kindness.

The James Watt Engineering Laboratories, of which Prof. A. Barr is the head, were open, and their excellent equipment was inspected by the visitors with great interest. A description of these laboratories has appeared in our pages.

On the following day the visitors were the guests of Messrs. Babcock & Wilcox, Ltd., to whose works at Renfrew they were conveyed by special train. They were

received by Messrs. J. Dewrance and J. H. Rosenthal, directors, and Mr. M'Laren, works manager, and were conducted through the works in detachments. Owing to their great extent, the variety of the work done, and the great activity prevailing in all departments, these works proved extremely interesting to the visitors. The works employ over 1,900 men, and turn out more than 1,500 complete boilers per annum, besides superheaters, mechanical chain-grate stokers, feed-water heaters, conveyors, &c. The use of cast-iron in the construction of the boilers has been abolished, the whole of the boiler being made of wrought-steel, and all holes are drilled. Hydraulic and pneumatic tools are freely used, and electric driving is also employed, power being derived for this purpose from a D.C. generating plant of about 1,000 H.P. Besides the well-known "Land" and "Marine" boilers, two other types, the "Cross" and "Portable" boilers, are made at Renfrew, and a crane-building department is being laid down.

After inspecting the works, the visitors entrained again, and proceeded to Greenock, where they embarked on the turbine steamer *Queen Alexandra*, and were taken for a cruise through the Kyles of Bute and up Loch Fyne to Ardrishaig, returning round the south end of the Isle of Bute, between the Cumbraes, and back to Greenock. The weather was sunny, with a light breeze, and all the conditions were present for a most enjoyable trip. Luncheon and tea were served on board the steamer. During the afternoon, the President, Mr. Gavey, expressed the visitors' appreciation of the generous hospitality of Messrs. Babcock & Wilcox, their admiration of the boiler works, and their enjoyment of the delightful excursion which had been arranged for their delectation. Hearty cheers were raised for the company, and Mr. Rosenthal briefly acknowledged the compliment, expressing the pleasure of his firm in welcoming its friends from abroad, and his hope that this might be only the first of many such occasions. We may add that it would be difficult to imagine a more delightful or successful excursion than that which was so admirably organised by Messrs. Babcock & Wilcox, and we feel sure that the local reception committee, which was at first somewhat doubtful as to the propriety of accepting the firm's hospitality, is now thoroughly satisfied as to the very happy outcome of its decision. Seeing that the members of the British Institution, who visited Germany, Switzerland, and Italy, were similarly entertained by private firms on a most lavish scale, we fail to see why any doubt should have existed on the question; certainly the visitors showed no more disinclination to take part in the excursion than our compatriots did on the former occasions—and we are not aware that *they* hung back in the least!

Boarding the special train again at Greenock, the party returned to Glasgow, and in the evening they were entertained at a reception and conversazione by the Corporation of Glasgow in the magnificent Art Gallery and Museum in Kelvingrove Park. There were about 2,000 guests, and the scene was both animated and picturesque. During the evening Bailie Watson and Councillor R. M. Mitchell welcomed the visitors, and Mr. R. K. Gray expressed the thanks of the electrical engineers for the splendid reception accorded them. Mr. C. H. Sharp, of New York, also spoke in praise of Glasgow, and Prof. Farny, of Switzerland, briefly expressed the pleasure of the visitors.

Next morning (Wednesday) the party left Glasgow for Edinburgh, where they arrived at 10 o'clock. Most of the members at once proceeded to explore the city in brakes, which awaited their arrival; others were taken to the McDonald Road Electricity Works of the Corporation, under the guidance of Mr. F. A. Newington and his assistant, Mr. Foyster. This station contains generating plant, having a total output of about 15,000 H.P., consisting of ten Willans and Belliss engines driving Siemens and Mather & Platt dynamos. There is a battery capable of discharging at 400 amperes for five hours, but there is no condensing plant. Bucket elevators and push-plate conveyors handle the coal, and the boilers, most of which are of the dry-back marine type, with two Stirling boilers, are fitted with mechanical stokers.

Close to the electricity works is one of the power stations of the Edinburgh cable tramways, and by the courtesy of the managers, the visitors were permitted to inspect the machinery, which consisted of two horizontal compound engines driving the cable drums through rope gearing. The arrangements made for regulating the tension of the cables excited much interest.

A drive through Edinburgh followed, after which the visitors were entertained at luncheon by the Corporation at the North British Station Hotel.

In the unavoidable absence of the Lord Provost and other leading members of the Council, Bailie Dobie presided, and after the loyal toasts, proposed the health of "Our Guests," whom he heartily welcomed. He referred to the fact that it was Independence Day, but that anniversary no longer excited ill-feeling.

Mr. J. W. Lieb, jun., past-president of the American Institute, in responding, thanked the Council for its hospitable reception of the visitors, and said he was proud on that day to acknowledge the debt of America to Scotland. He also expressed the greatest appreciation of the organisation of the tour, which had been most successful; the I.E.E. had broken all records. Mr. H. M. Brooks seconded Mr. Lieb, and commented on some of the differences between British and American practice in tramway promotion; Mr. E. Brylinski also responded to the toast, speaking very rapidly in French. Councillor Stevenson then proposed "The Institution of Electrical Engineers," but unfortunately he had perused an out-of-date list of officers, and was one year behind time in his references to the presidential excellencies. Mr. Gavey, in response, remarked on the revolution effected by electrical science, and Mr. W. M. Mordey claimed that the electrical had become the most important branch of engineering.

Dr. R. T. Glazebrook then proposed "The City of Edinburgh," to whose beauty he paid a tribute of admiration, and the chairman, in responding, stated that there was no doubt in Edinburgh that electric lighting was superior to gas.

After luncheon there was time for the further exploration of the city, a flying visit to the Forth Bridge, &c., before the visitors resumed their journey. In spite of a slight mistiness, the day was gloriously fine, and "Auld Reekie" looked her very best; the visitors, especially those from abroad, were keenly interested in the numerous monuments, historic buildings, old customs, &c., which they observed, and greatly enjoyed the day spent in Edinbro'. In the evening they recrossed the Border, arriving at Newcastle at 8.40 p.m.

(*To be concluded.*)

## CORRESPONDENCE.

***Letters received by us after* 5 p.m. on Tuesday *cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.***

### The R.A.S.E. Suction Gas Plant Trials.

We shall feel much obliged if you will grant us a little space in your "Correspondence" columns to place before your readers some facts concerning the above trials, and the awards which have been made by the judges in connection with them. We have felt so strongly over this matter that we have entered an official protest against these awards being made.

The printed regulations of the R.A.S.E. set forth the special points to which attention would be given, and these were as follows:—

1. Attendance necessary.
2. General design, including facility of cleaning and space occupied.
3. Regularity of running.
4. Fuel consumption, water consumption.
5. Price.
6. Relative proportions of gas producer and engine.
7. Volume swept by piston relative to brake-horse-power.

The above regulations were the special points on which the awards were to be based, and we respectfully protested that such points had not been duly considered in connection

with our gas engine and gas plant which the judges selected for their further trial on Saturday, June 23rd last, along with the engines of Messrs. Crossley Bros. and the National Gas Engine Co., Ltd. The grounds of our protest are as follows :—

1. *Attendance Necessary.*—We have pointed out that in our gas engine and gas plant we had only one attendant, who performed all the work in connection with the starting and running, whereas the two successful engines had at least two attendants to do the same work. Further, the time taken by our attendant throughout the trials to start our gas engine and gas plant was about 50 per cent. less than the time taken by either of the above two firms.

2. *General Design, including Facility of Cleaning and Space Occupied.*—As to the general design of the engine, we claim for it that it is considerably in advance of any of the engines entered for competition, for the following reasons :—

(*a*) The extended bedplate supporting the engine cylinder practically the whole of its length.

(*b*) The facility with which the ignition of the engine can be advanced or retarded while the engine is at work, to suit the kind of gas being used at any time. This important feature does not exist in either of the two successful engines.

(*c*) The ring lubrication fitted to the crankshaft bearings.

(*d*) Forced lubrication fitted to the engine piston.

Other details, such as the waste oil trough round the engine bedplate and loose exhaust valve seats and loose guides for the exhaust valve spindles, might also be mentioned.

As to the general design of the gas plant, the following special points should be noticed :—

(*a*) The superheater used is of the most simple character and one which permits of its being cleaned in a very easy manner.

(*b*) The generator is fitted with a cast-iron base preventing either internal or external corrosion, and gives a much longer life than one made of steel plate.

(*c*) Every detail part of our gas plant and pipe connections is fitted with loose doors through which each part can be cleaned. The gas plants of the successful engines have not any doors fitted on the pipe connections and bends in their gas plants, and to enable the interior of their scrubbers to be examined, cleaned or filled, the main gas pipe has to be entirely removed, an operation entirely unnecessary in our gas plant.

*Space occupied.*—We emphatically claim that our gas engine and plant can be put into less space than either of the successful competitors, as an examination of this will prove.

3. *Regularity of Working.*—We claim that our gas engine and gas plant have proved more regular in working than either of the successful competitors. The gas made by the plant was regular in quality, and did not necessitate any adjustment of the air throttle from time to time. The engine worked in a very regular manner, though it was fitted with less weight of fly-wheel than any of the two successful engines.

4. *Fuel Consumption, Water Consumption.*—As to fuel consumption, we are unaware what amount of fuel was consumed by the successful competitors, but we do know that consumed by our engines and plant. If none of the coal taken out of the generator and unused by us, be credited to us, our coal consumption is 1·20 lb. per B.H.P. per hour ; if all such coal be credited to us our consumption is 1 lb. per B.H.P. per hour. The consumption of coke used in our engine was 1·25 lb. per B.H.P. per hour, if the coke returned be credited. (It is to be noted that these consumptions include all standby losses, &c.) Such fuel consumptions as these will compare at least favourably with those of the successful plants, but it has to be specially noticed in this connection that the judges told the competitors that fuel consumption was not the most important feature of the trials.

As to water consumption, we made no special effort to reduce this in the trial, believing that the conditions to be observed were such as would be obtained in ordinary everyday work. Our water consumption under these conditions works ont to 1½ gallons per B.H.P. per hour. Such consumption could easily be reduced, if necessary, at the expense of having dirty valves, dirty piston and a dirty cylinder.

The other three points in the regulations issued by the R.A.S.E. do not call for notice here.

We beg to say in conclusion that the engine exhibited by us was one of our standard character, and has nothing of the purely racing element about it. It was one which could be safely put in the hands of an unskilled person.

On the above grounds, we have protested against the awards which have been made, and we feel most strongly that if such decisions as these are to be characteristic of future trials of the R.A.S.E., no competitor can have any assurance that his machine or implement will receive that careful treatment to which he is at least entitled.

In consequence of our having submitted our official protest, we have received from the secretary to the R.A.S.E. the following reply :—

"I am instructed to acknowlege the receipt of your letter of the 28th inst. (June) respecting the awards made by the judges in the suction gas plant trials at this show.

"The protest was formally reported to the Council at their meeting held yesterday in the showyard, and instructions given for your letter to be submitted to the judges and the Society's consulting engineer for their observations and report for consideration by the Council."

We leave the matter here for the present, and we ask for your indulgence in placing this matter before your readers, as we know that others besides ourselves who entered the competition feel as strongly as we do in this matter, and that it is not simply our own feeling which prompts us.

*pp.* **The Campbell Gas Engine Co., Ltd.,**
HUGH CAMPBELL.

Halifax, *July 3rd*, 1906.

---

### Inaccurate Electricity Meters.

The question has been raised—When a meter is removed from the premises of a consumer to the supply authorities' test room and found inaccurate, what may be done ?

For a supply authority to remove a meter from a consumer's premises when there is any doubt as to its correct registration is a risky thing to do, except by the consumer's request, unless the amount of energy supplied by the undertakers to the consumer shall have been agreed upon beforehand. It is a very easy thing in cases of this kind to ascertain the accuracy or otherwise of a consumer's meter by putting an accurate meter in series with it before removal.

The removal of a meter not only removes with it a great deal of the evidence as to what state the meter was in when on the consumer's premises, but it also puts doubts into the consumer's mind as to what fairness of treatment he is going to get from the supply authority.

An electric lighting order which I have before me states : —"The amount of energy supplied . . . . shall, except as otherwise agreed between such consumer and the undertakers, be ascertained by means of an appropriate meter duly certified, &c." It would therefore be possible to use uncertified meters, providing that that means of measuring the energy supplied is mutually agreed upon by the consumer and the undertakers.

In the event of a meter proving consistently inaccurate, it would likewise be possible for the consumer and undertaker mutually to agree upon the amount of inaccuracy, and thus still have a correct account.

In the event of a meter having acted erratically, it is impossible to go by it at all, and the amount of energy supplied must be ascertained and mutually agreed upon by some other means, the fairest of these undoubtedly having reference to that consumer's similar quarter's consumption in other years.

Should it be impossible by the above or similar methods to ascertain the amount of energy supplied and agreed upon, the only course left is to appeal to the Board of Trade inspector, whose decision is final. But one thing is certain, the fact of the supply authority having removed the meter would not help to uphold any claim they might make against the consumer.

With regard to knocking something off a man's bill, if "Only One Case" means that the amount of energy supplied to his consumer has been ascertained by some system mutually agreed upon, *i.e.*, probably by an uncertified meter, and that

that meter is accurate, then he has no right to allow anything off the account; he must remember that his auditors have to be satisfied, which they would not be if he acted in this manner.

If his consumer is so convinced that his account is wrong, let him substantiate his conviction by putting down the cost of a Board of Trade inspector's test, and return it to him with an amended account if his meter is found to be wrong.

Our troubles are sometimes bad enough, but for goodness' sake do not let us make them ten times worse by corruption of this kind.

**David Smith.**

Tunbridge Wells, *July 3rd*, 1906.

---

The letter which my assistant wrote, and which was printed in your issue of June 22nd, signed "Meters," has not called forth the comment which the subject deserves.

I should be glad if other central station engineers would give their views, and perhaps your legal contributor would kindly wind up the discussion with an expression of his views.

**S. E. Fedden,**
*Manager, Corporation Electric Supply Department.*

Sheffield, *July 6th*, 1906.

[Our legal contributor has already dealt with the matter, and his views will be published in an early issue.—EDS. E.R.]

---

### Manufacturers Selling Direct to Consumers.

It would be interesting to have the opinion of those contractors who are feeling the pinch—and few are not—of the best way to prevent the selling direct to consumers by manufacturers. Some of the latter are so anxious to do business that they have adopted a glorified system of hawking. They fit up a showroom at the leading hotel, issue invitations to—sometimes the local contractors—always the local architects, engineers and "shippers" (this covers a lot), and should a doctor who is building a new house, or a draper about to open another "emporium," or a publican who is wiring his hotel, happen to hear of the exhibition—I note they usually do—the hawker (pardon, traveller) is so busy that he has not time to distinguish between the trade and "The Trade." This competition is grossly unfair, and I wonder what other body of tradesmen would take such treatment lying down as the E.C.'s appear to do.

**M. McBratney.**

Newport, Mon.

---

### Tramcar Brakes.

May I be permitted a few remarks on the above subject, referred to by "Tramway Engineer" in your issue of the 6th inst. This gentleman tells us that up to the present there has not been a case of a single car fitted with mechanical track brakes running away downhill. Your correspondent may possibly be interested to learn that during 1902 (if I may go so far back) at least two serious accidents occurred in the West of England, in which the cars involved were fitted with mechanical track brakes, and got beyond the drivers' control while descending gradients.

At inquiries into such accidents, the question of sand-boxes acting is one that is very rarely raised, and to which but slight importance is usually attached; yet every tramway engineer knows that, under certain conditions, the best brakes on the market, whether electrical or mechanical, may be rendered useless by the failure of the sanding gear—that is, useless so far as stopping the car is concerned. A mysterious haze often envelopes the cause of such mishaps, although, in the absence of a better reason, the fault is usually laid on the electric brakes.

"Tramway Engineer" states that "it is well known amongst electrical engineers that electrical contrivances are not to be relied upon." Such a statement is surely rather sweeping, and by no means complimentary, to the manufacturers of some of the splendid equipments that for years have been giving such good service on our older systems.

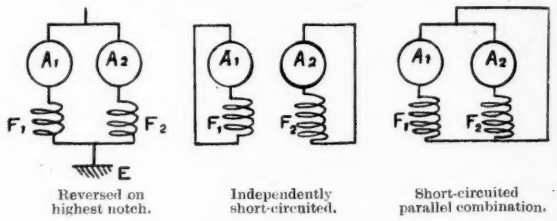
Every tramway engineer will, I think, agree with me on this point—on every system serious accidents are daily avoided by the promptitude with which motormen bring their cars to a standstill. Are mechanical brakes responsible for such smart stops? I think not. A track brake that will bring a car moving at, say, 10 miles an hour to a stop in 30 ft. is very rarely met with, yet the unreliable (?) electric brake does this often in the course of a day's run.

As regards electric brakes, these are no more unreliable (when looked after by an electrician) than a mechanical brake is.

If a pair of machines perform their functions properly whilst propelling a car, it may be safely said that they will act equally well when used for braking, taking for granted that reversal of armature or field connection is properly effected. I speak generally and without regard to very rare electrical faults which might occur to prevent such a change of function being successful.

Looking further afield for the cause of any probable failure, we will turn to the controllers, whose contacts are a frequent source of failure of the electric brake. Whether they be of the emergency stop, or the rheostatic brake type, we are not confined to one position for an emergency stop. Should the ordinary electric braking position fail to produce a reduction in the speed of the car, after making sure she will not "catch" on any notch (in the case of a rheostatic brake), if the controller be reversed on to the highest notch, the effect will be found the same as if the motors were (*a*) independently short circuited, or (*b*) coupled in a short-circuited parallel combination with no resistance in circuit in either case.

These diagrams may explain my meaning:




Reversed on highest notch. Independently short-circuited. Short-circuited parallel combination.

There is practically no difference in the violence of these different stops, and it will be seen that a driver has another brake, practically; as a bad connection which may render the ordinary electric brake inoperative, may not come into use on the reverse position of the controller. A knowledge of this extra braking facility on the part of drivers would, I believe, save many deplorable accidents caused through failure of the rheostatic or emergency brake. I may say that I have come across many drivers of experience, and even depôt electricians who have expressed surprise that such a brake should exist in addition to the regulation one provided.

Whether current be in the wires or not is immaterial to the action of this stop, as, in any case, a fuse would go, should a rapid reversal take place, and render the car circuits dead.

In conclusion, I may say that another frequent cause of electric brake failures is dirty commutators. The explanation is simple: A 400 or 500-volt starting current easily overcomes the resistance offered by the dirt on the commutator, whereas the infinitesimal current which starts the circuit for braking utterly fails to accomplish this—consequently, no excitation.

**S. C.**

---

### Electrolysis and Joint Boxes.

In further reply to correspondence *re* above, I note that "Mains Engineer" queries the advisability of preventing lead sheathing from being continuous on account of the possibility of upsetting testing facilities. Granted that the lead sheathing is often used in connection with such tests on L.C. cables: it is impossible for it to be used on other classes of cables, such as bitumen and rubber insulated where a lead sheath is non-existent.

Therefore, the use of boxes made of insulating material to split up an L.C. network would merely bring such a system

in line with a leadless cable system, so far as testing facilities are concerned; and this latter system has been in use quite long enough to ensure that the arrangement is no mere experiment.

Further, some engineers have had so much trouble from electrolysis that they use wooden bushes in the glands of the joint boxes to interrupt the current; but, as pointed out in my article, a joint box made of permanently insulating material would be more reliable. I trust this is now clear to "Mains Engineer," and am pleased to deal with his courteous comments.

As regards "Sero sed Serio," to save your space, his vituperation can stand for what it is worth, and to the trifling argument he advances the following applies.

In support of his contention that "electrolysis" was a common term 15 years ago, he can only state that a composite duct was in use in America at the time the important books, &c., mentioned by me, were written; in which books (dating from 1892 to 1899) no reference is made to this "common term." Is this argument, or—to use his own elegant expression—"blowing off?"

"Sero" further states that the "lead box tee joint" is the *present practice*. This reminds one of the three tailors of Tooley Street who represented the people of England.

Bushes used as insulators and as lead sheathing protectors are discussed by "Sero" with the assumption that he is saying something new. If he will take the trouble to look over my article he will see that he has but confirmed the statements there, with the exception of his description of armoured cable jointing, where he mentions one method as the invariable practice. It may have been so as a personal experience, of course.

"Sero's" dealings with insulating joint boxes incidentally show him up rather badly. An engineer who uses a box filling compound which allows damp to damage his cables by creeping through a bush, or in any other way, deserves all he gets!

**The Writer of the Article.**

*July 8th*, 1906.

## DEVELOPMENTS IN THE BASTIAN MERCURY VAPOUR LAMP.

From time to time these pages have contained records of the progress made by the mercury vapour lamp, for considerable progress has been made, although the lamps are admittedly still capable of great improvement.

The Bastian type of lamp is of peculiar interest, owing to its English origin and to the very practical designs adopted by the makers. So recently as January, 1903, the first patent was taken out for this lamp, and about the middle of the following year the first few lamps, arranged to burn four in series across 200 volts, were sold.

By the end of the year 1904, it was found possible to construct the lamps to burn singly on any voltage up to 250 volts, and since that development, little, if any, change has been effected in the method of manufacturing the burner, except as regards improved methods of annealing, &c.

The burners are made of hard Jena combustion tubing, and as this glass has a much lower coefficient of expansion than platinum, considerable difficulties have had to be overcome in effecting a thoroughly reliable sealing-in of the platinum leading in wires, but that these difficulties have been overcome is evidenced by the fact that many burners have lasted over 5,000 hours in actual use, and one, specially tested, had a life of over 10,600 hours under conditions of practical use. During this long period very little discoloration of the glass took place, except for a short length of about ½ in. near the negative electrode, and it is claimed that the efficiency of the lamp was not reduced more than 5 per cent. thereby.

About 3,000 lamps have now been sold, and these are being used in a great variety of situations, principally in combination with carbon filament lamps, as the combination results in a pure white light, which preserves all colours at their true daylight tint. The lamp is, therefore, invaluable for decorative and colour matching purposes, and owing to its resemblance to daylight, it is not fatiguing to the eye.

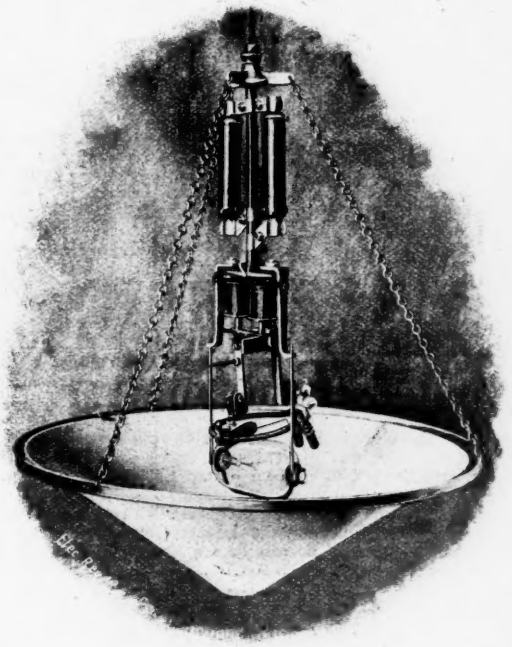
One of the first public trials of the Bastian lamp was in the clock tower at Westminster, but it was made at a time when Parliament was exceptionally busy, and in order to avoid the waste of public time occasioned by the numerous questions in the House as to the unwonted appearance of Big Ben's complexion, the experiment was discontinued by the order of the authorities.

It was publicly stated in the House of Commons, however, that the new lamps had been tested to give a clearer definition of the figures on the clock, and that their introduction would effect a saving of about £70 a year in energy consumption. We understand that instructions to renew the experiment have been given.

Other public clocks at Rotherham and Wigan are successfully lit with Bastian lamps, and a few of the various purposes for which these lamps are being used are as follows:—

For illuminating the glass roof of the principal lounge in the Ritz Hotel, Piccadilly, W.; the Court Yard at the Great Central Hotel, Marylebone; car-sheds at Rotherham and Rothesay; showrooms at Waring & Gillows, Manchester; office of the Midland Railway Co., Derby; streets at Wigan and Barnsley; Kodak, Ltd., for photographic purposes; Dr. G. Johnstone Stoney, for microscopic purposes; Prof. Troughton, for spectroscopic research, &c.

These examples illustrate some of the special applications of the lamp, which is, however, used in ordinary lighting work in many shops. It is almost superfluous to remind our readers that this type of lamp is highly efficient, being some ten times better than the ordinary incandescent lamp; and to those who object to the colour of the mercury vapour, pure and simple, it will be interesting to know that the firm is busily experimenting with a view to colouring the arc stream by the addition of other metals to the mercury.



The Bastian Mercury Vapour Lamp, Pendant Type.

Our illustration shows one of the latest patterns of lamp, used by ourselves for office illumination; as will be seen, it is combined with an incandescent lamp, thus obviating the colour difficulty for internal work. The lamp is not essentially different in construction from earlier ones described in our pages, but it is improved in several minor points.

Sole licences to work the patents in France and Spain have been acquired by the Compagnie Generale d'Electricité, of Paris, and in Switzerland the sole licence is held by the Schweiz Gluhlampen Fabrik, of Zug, whilst the Cooper-Hewitt Electric Co., of New York, have acquired an option to purchase all the rights in the United States and Canada.

The grant of the company's patents has been opposed in several foreign countries, but the firm has so far in all cases successfully contested such opposition, and the German patent which was opposed has just been finally sealed with the full broad claims originally allowed by the German Patent Office.

**Bennis Stokers.**—At the Health Exhibition, which is now running in connection with the Congress of the Royal Sanitary Institute at Bristol, Messrs. Ed. Bennis & Co., Ltd., at stand No. 19, have on view their "Bennis" and "Miller-Bennett" chain-grate stoker, the "Bennis" mechanical stoker and compressed air furnace and the "Bennis" new patent coking stoker.

**Large Order for Gas Engines.**—We understand that the Indiana Steel Co. has given the largest single order for gas engines ever placed by one company. It is for eight Westinghouse twin-tandem, double-acting, horizontal gas blowing engines of 3,000 H.P. each, capable of delivering 30,000 cb. ft. of free air per minute to the blast furnaces which produce the gas which, in its turn, is also used to operate the engines.

## PARLIAMENTARY.

### The Supply of Electrical Fittings by Borough Councils.

The London County Council's General Powers Bill came before the Earl of Camperdown's Select Committee of the House of Lords at the latter end of last week. Among the clauses which were passed was one providing for the supply of fittings by Metropolitan Borough Councils. The only opponents were the Electrical Contractors' Association, who submitted certain amendments, which, unfortunately, were rejected. The clause is as follows:—

"It shall be lawful for the Council of any Metropolitan Borough being authorised to supply and supplying electrical energy, to expend money upon the wiring and fitting and supplying with wires, fittings, motors, and apparatus, the premises of their consumers or prospective consumers, and to enter into and carry into effect agreements and arrangements with respect thereto, and to make such charges therefor as they may think fit.

"Provided that nothing in this section shall be deemed to authorise the Council of any Metropolitan Borough to manufacture any such fittings or apparatus.

"Provided also that every such Council shall so adjust the charges to be made by them as aforesaid as to meet any expenditure by them under the powers of this section (including interest upon any moneys borrowed under and for the purposes of this part of this Act and payments to sinking fund in respect of such moneys).

"Every sum charged by any such Council to a consumer in respect of the wiring and fitting of the premises of such consumer and the supplying of wires, fittings, motors, and apparatus shall be clearly stated in every demand note by such Council for payment for electrical energy supplied to such consumer, distinct from the charge for such energy.

"The total sums received and expended by any such Council under this part of this Act in each year (including the amount required for interest on and payments of sinking fund in respect of moneys borrowed) shall be separately shown in the published accounts of the electric lighting undertaking of such Council for such year.

"Any such Council of a Metropolitan Borough may borrow in the same manner and subject to the same conditions as if such expenditure were for the purposes of 'The Electric Lighting Acts, 1882 and 1888' as amended by the 'London Government Act, 1899' any such sums of money as may be required by such Council for the purposes of this part of this Act."

### L.C.C. Tramways Bill.

(*Continued from page* 16.)

Coming to the question of general finance, Mr. Hutchinson said that he would show that there was no pressing necessity for this scheme. There would be a loss on the tramways, "and," learned counsel continued, "I have shown you what this unknown loss is going to be"—a statement which was received with loud laughter. Continuing, Mr. Hutchinson said that, but for the ill-timed laughter, he would have completed his sentence. He meant that he was going to show what would be the effect of the unknown loss upon the finance of the Council. He left aside the whole question of danger and the matter of the passengers stepping off the trams into the middle of the street, where dangerous vehicles like motor-cars were running up and down, because, although those details affected the safety of the public, they were swamped when one came to other considerations. Referring to the special report, Mr. Haward had told him that the Council had spent on the southern system £3,000,000, and that there remained £1,000,000 yet to be expended. On the north the position was reversed. There was £1,000,000 which had been spent, presumably in the purchase of horses and rails which were worn out and tramcars which would be swept out of existence, and they had got to spend £3,500,000. Not only had the Council been 10 years in considering whether they should operate the northern tramways electrically, but they had spent £22,000 upon plans, and yet they could not tell when the 3½ millions would be spent. His submission on that point was very short, and it was this: He put it to Capt. Hemphill whether it would not be well to put the horse before the cart in this instance, and before they made a connection involving an unknown amount of capital and involving an unknown loss, to occupy themselves in spending the 3½ millions in giving the tramway communication which the people in the North wanted. They would then, when that tramway came into existence, have the thing ripe and ready for connection by some means. Here they had tramway works authorised which were going to cost 3½ millions in the north and a million in the south, and also new lines elsewhere which were going to cost £1,100,000.

The Chairman: £6,000,000.

Mr. Hutchinson: Yes, £6,000,000, and part of it a scheme which has been waiting for 10 years. Mr. Haward had told him that the capital debt of London was at the present time 45¼ millions, and that the rateable value, as the result of quinquennial valuations and increased assessments, had increased in 10 years from 36 to 43 millions.

The Chairman remarked that £11,000,000 was due to the Education Act.

Mr. Hutchinson said that he did not think that was taken into consideration. At any rate, eliminating education, the burden on the ratepayers had increased on the one hand 20 to 24 per cent., the amount paid in rates, irrespective of education, had increased 3d. in the £. The result was that the financial burden in 10 years had increased by 25 per cent. He asked the Committee to say that the Bill should not proceed. It would, he concluded, give the stocks of the Council a much needed rest.

Mr. Lewis Coward, K.C., then addressed the Committee at some length on behalf of the omnibus companies, his arguments turning upon the question of renewals, &c.

Mr. Moon, K.C., replied for the L.C.C., dealing with the various petitions one by one. Considering the question of renewals, he referred to a passage in the Traffic Commissioners' Report in which that subject was dealt with. This passage ran "An end-on break in the course of a journey probably caused additional expense (for two independent fares usually cost more than a through fare), whilst the consequent delay and discomfort, especially in bad weather, and the uncertainty of trans-shipment, are great drawbacks. Where the line abruptly terminates in the middle of a crowded street, even greater discomfort is caused, together with serious diminution of efficiency in the entire tramway service, and an intolerable congestion in the streets. It is difficult to appreciate how such a state of things can have been tolerated for so long. Whatever view may be held upon the expediency of extending tramways in London, it cannot be expedient to work those we have upon inefficient methods." The expenditure which was proposed by the present Bill, Mr. Moon observed, was to remedy the inefficient methods in regard to two of the main termini south of the Thames. The provision for renewals was such that it would renew the plant at the end of its life and would pay for repairs during the interval.

Wednesday, July 4th.

The Chairman of the Committee, Earl Camperdown, said that having considered the Bill, the Committee had decided in regard to the "circuit scheme," that that portion of the tramways might proceed.

The City Corporation Bill for the widening of Blackfriars Bridge was then taken, the only opposition being from the Metropolitan Water Board.

A clause by which that authority were to have powers to lay mains over the widened bridge was inserted, and the Bill was ordered to proceed.

The consideration of that part of the L.C.C. Bill, which refers to the taking of land at Wellington Road, Bow, for the purpose of a car-shed, was then proceeded with.

Mr. Reader Harris, K.C., for the Poplar Borough Council, contended that the site ought not to be taken. It was part of the best residential quarter of the borough, and there were other sites available, one of them in an insanitary area, and an endeavour should be made to obtain one of these before the Council was allowed to take the Wellington Road site.

Mr. Moon, K.C., replied on behalf of the L.C.C.

The Chairman said that the Committee had come to the conclusion that when they came to consider the clause in which it was proposed compulsorily to take the site, the words must be struck out of the Bill.

Clauses were then adjusted.

---

**Metropolitan District Railway.**—Mr. Nield asked in last Friday's "Parliamentary Papers" if the President of the Board of Trade was aware that the District Railway had, for many hours of the day, reduced the carriages making up a train to four, and in many cases three, and that, as a result, much overcrowding and inconvenience were occasioned to travellers, not unattended with danger; and whether he would consider the advisability of making representations to the company on the subject, and, if necessary, framing regulations which should prevent a continuance of the practice complained of. Mr. Lloyd-George replied that complaint had been made to the B. of T. that the Metropolitan District Railway Co. had reduced the number of carriages making up certain of their trains, and he had been in communication with the railway company on the subject. The company now informed him that the frequent services of seven-car trains, which were at first provided after the introduction of electric traction upon their line in 1905, were found to be in excess of public requirements, and had consequently been curtailed from time to time. The company added that they still had these services under careful observation, and were of opinion that the trains at present run met the requirements of their passengers. If the honourable Member would furnish specific instances of habitual overcrowding of these shortened trains, further inquiry should be made, but the Board of Trade had no powers which would enable them to frame regulations of the nature suggested.

**Folkestone and District Electric Supply Bill.**—The Bill came before the Unopposed Bills Committee of the House of Commons on Thursday last week. The measure is to authorise the company and the Corporation of Hythe and U.D.C. of Sandgate to enter into agreements for the exercise by the company of the powers conferred on the Hythe Corporation and U.D.C. of Sandgate by the Hythe Electric Lighting Order of 1900 and the Sandgate Order of the same year. The powers contained in the Bill include a transference of the undertakings. The measure was allowed to proceed.

**South Wales Electrical Power Distribution Co.'s Bill.**—The Unopposed Bills Committee of the House of Commons connected this Bill on Thursday last week and ordered the measure to proceed. The Bill refers to the re-arrangement of the capital and power is taken to raise £1,000,000 additional capital for the purpose of carrying out the obligations of the company in the area of the Carmarthenshire Co. which has been transferred to them.

**London Electric Supply Bills.**—In the House of Commons on July 5th (according to the *Times*) objection was taken to the second reading of all the metropolitan electric supply Bills, and their consideration was again deferred.

**Second and Third Readings.**—In the Lords on July 3rd the Metropolitan District Railway Bill passed third reading.—In the House of Lords on July 5th the Cork City Railways Bill was read a second time.—In the House of Commons on 4th inst. the Folkestone, Sandgate and Hythe Tramways Bill was read a second time. Leave was given to the promoters of the Hammersmith, City and North-East London Railway Bill to suspend further proceedings in order to proceed with the same Bill, if thought fit, next session.—In the House of Lords on July 9th the North-East London Railway Bill passed its third reading.—In the House of Commons on Monday the Kent Electric Power Bill was read a second time.

**Kingston-upon-Hull Corporation Bill.**—After a protracted hearing relative to the portion of the Bill dealing with docks, the Select Committee of the House of Commons, presided over by Mr. Mooney, has passed the preamble of the above Bill, which provides for the extension of the tramway system and of the generating station, for the supply of electrical energy in bulk to neighbouring authorities or companies, &c. Clause 76 of the Bill proposed that for the purpose of supplying electrical energy outside the city the Corporation might, with the consent (which consent should not be unreasonably withheld) of the local authority of any urban or rural district in or through which it might be necessary or expedient to enter or pass, lay down such electricity mains and works as might be reasonably necessary for the purpose, and that, if such consent be unreasonably withheld, the question should be determined by an arbitrator appointed by the Board of Trade. The Committee reported that a report had been received from the Board of Trade on this clause, and it had been withdrawn. It was agreed to allow a period of 30 years for the repayment of the loan of £75,000 required for the construction of tramways and other tramway purposes.

**Cumberland Electricity and Power Gas.**—This Bill is promoted for the purpose of incorporating a company with a capital of £450,000 to establish generating stations, &c., for the supply of electricity and power gas in a part of Cumberland comprising the boroughs of Workington and Whitehaven, the urban districts of Aspatria, Maryport, Cockermouth, Harrington, Chaton Moor, Egremont and Keswick. Powers are also taken to apply for provisional orders, and to transfer certain existing orders. The Bill came before the Unopposed Bills Committee on Thursday last week, and was ordered to proceed.

**London United Tramways Bill.**—On July 3rd the Bill promoted by the London United Tramways Co. for further powers to make road widenings, so that authorised tramways can be constructed, came before Lord Onslow's Committee of the House of Lords. Sir J. Clifton Robinson, chairman and general manager of the company, briefly gave evidence in proof of the preamble, and the Bill was ordered to proceed. The Bill has already passed third reading in the House of Commons.

**Huddersfield Corporation Bill.**—The above Bill, which, amongst other things, authorises the construction of six small sections of tramway, came before the Unopposed Bill Committee of the House of Lords on July 3rd, and was ordered to be reported for third reading.

**Macclesfield and District Tramways Bill.**—On July 3rd this Bill, which authorised the formation of the Macclesfield and District Tramways Co. with a capital of £135,000 to construct tramways, was before Lord Onslow's Committee of the House of Lords. The total estimate of the tramways with road widenings was £83,431. Mr. Bell (Parliamentary agent) called formal evidence to prove the preamble, and the Bill was ordered to proceed.

**Light Railway Advances.**—In the Parliamentary papers of Friday last, Mr. Thornton asked the President of the Board of Trade what was the aggregate of the sums advanced by the Treasury up to the present time under Sec. 4 of the Light Railways Act, 1896, and of special advances under Sec. 5 of that Act; whether there were any outstanding payments still to be made under either section; and whether it was the intention of the Government to institute any inquiry into the working of the Act by means of a departmental or other committee. Mr. M'Kenna replied that under Sec. 4 of the Light Railways Act, 1896, £13,500 had been advanced up to the present time, and further loans amounting to £35,000 had been conditionally agreed to. Under Sec. 5, special advances had been conditionally agreed to amounting to £212,495, of which £139,128 had been actually advanced, leaving £73,367 outstanding. The President of the Board of Trade informed him that he saw no reason for the appointment of a committee as suggested.

---

**United States.**—Niagara Falls power is now being delivered in Syracuse, New York State, at a distance of 150 miles from the source of supply. This transmission breaks all previous records for distance from the Falls locality. The power is developed by the Ontario Power Co., of Niagara Falls, Ontario, and is transmitted by the Niagara Lockport and Ontario Power Co. The power will be utilised in Syracuse for street railway purposes, and will be conveyed over three cables.

**Association of Engineers-in-Charge.**—By the courtesy of Mr. H. Tomlinson-Lee, chief electrical engineer, a visit is to be paid to the Wimbledon electricity works on Saturday, July 14th. A visit to the engineering department of the House of Commons will take place on Saturday, July 28th.

# LEGAL.

THE KING *v.* MOUNTFORD (*ex parte* LONDON UNITED TRAMWAYS (1901)).

THIS case came before a Divisional Court of King's Bench on Wednesday last week.

Mr. ELDON BANKES, K.C., said he appeared to show cause against a rule obtained by Mr. Roskill, K.C., on behalf of the London United Tramways Co., calling upon Mr. Mountford to show cause why a certain inquisition verdict and judgment taken before the Sheriff of the County of Surrey on February 26th should not be quashed on the ground of excess of jurisdiction. The facts were shortly these: Mr. Mountford was a dentist who carried on his practice at Eden Street, Kingston, in a house which for many years had been associated with a dentist's practice, and he had paid a considerable sum for the goodwill to the prior occupier. He held the house under a lease for a term of years which was unexpired. The tramway company, under its powers, gave Mr. Mountford notice to treat for a strip of land which formed part of the forecourt of the house; the strip was about 10 ft. wide × 170 ft. long, and included a portion of the garden and a portion of the stable. The object of giving that notice was to widen the street so that a double line of tramways might be introduced into that particular street. Mr. Mountford's claim for compensation was originally put under three heads, but one was, he thought, afterwards abandoned. He claimed compensation for the value of the land taken, and compensation for the damage done to his business during the time the works were being executed, because the street was shut up, and for a considerable number of months people were unable to go to the house. The third head of claim was for injury done to his premises and the goodwill of his business by reason of depriving the house to a certain extent of its approach, and by reason of the injury to the light of the room in which Mr. Mountford carried on his practice; also by reason of injury to the stable, and further, compensation for injury to or depreciation of the goodwill by reason of these matters and in consequence of the alteration of the character of the neighbourhood by the company bringing the tramways there or running the cars there. Eden Street was a street well suited for the practice of a dentist, and the tramcars coming there had altered the character of the street.

Mr. Justice PHILLIMORE said he did not think Mr. Mountford had any better claim to be compensated for that than any other professional man in Kingston.

Mr. BANKES said that part of Mr. Mountford's premises had been taken, and the case was exceptional. The rule was granted upon the ground of excess of jurisdiction, the company alleging that the notice to treat was served in pursuance of their powers under their Act of Parliament, which powers authorised the street widening, and they said that no compensation could be awarded to Mr. Mountford by reason of the laying down and opening of the tramways, which were authorised. The learned counsel said their Lordships had nothing to do with the amounts of compensation awarded, or whether the witnesses had taken a right or wrong view of the matter. The sole question was whether there was an excess of jurisdiction on the ground that Mr. Mountford had no right to put before the jury those considerations, and that the jury had no right to take them into account in assessing the compensation. Mr. Mountford's case was that the street had been brought nearer to his house, and therefore the public were brought nearer, and there was consequently a loss of privacy. But that was altogether apart from the question of use by the undertakers of the undertaking. But Mr. Mountford did go further, and did put before the jury as a element for their consideration, the user by the undertakers of the undertaking by tramcars, which, he said, affected him in two ways, by bringing the public into a position of seeing into his rooms, and, secondly, by altering the character of the street so that it ceased to be a business street, and became a street unsuitable for business people. His (Counsel's) case was that the company within the meaning of Sec. 63 of the Lands' Clauses Act had done Mr. Mountford damage by reason of the exercise of the powers of that or the special Act. He said that was the test in the case. The company were proceeding under a special clause, which gave them the right to take a portion of a man's land. As a matter of fact, the claim in the present case was made out by the claimant himself. He submitted that there was no ground for interfering with the verdict.

Mr. ROSKILL, K.C., in opening the case for the tramway company, said that the exercise of the powers under the Act of 1902 was confined to one thing, viz., the purchase of a portion of the claimant's forecourt for the purpose of throwing that portion into the footway and a little piece of the street. The exercise of those powers was not sought by the company under the Act of 1901, but was put upon the company by the Corporation of Kingston under Sec. 35 of the Act of 1901, which was a protective clause inserted for the protection of the Corporation, which prohibited the tramway from being open for public traffic until the street widening described on certain signed plans was effected, and as no powers were sought by the company under the Act of 1901 to effect these street widenings, they had to apply to Parliament for powers. The question raised in the case was of great importance to tramway companies. What had happened was this: The company had taken part of the forecourt of the claimant for a specified purpose, and not for the purpose of the company's undertaking at all. It was taken for the express purpose of widening the street. *Ex hypothesi*, the claimant had received compensation for the loss of privacy by putting his boundary wall 10 ft. nearer to his house, which

involved the public going into the widened footpath. The claimant secured that, and the company did not dispute that he was entitled to it. But he submitted that the claimant was not entitled to claim for the loss of his business and the privacy and his amenity through the running up and down of the tramcars, for the noise and vibration involved, and the peeping down into his room from the tramcars. That was the way he put his case.

At the conclusion of the arguments of counsel, their Lordships reserved judgment.

---

### Umballa Residential Hotel Co., Ltd., *v.* the County of London Electric Supply Co., Ltd.

In the Court of Appeal on Wednesday last week, the Master of the Rolls and Lord Justice Cozens-Hardy had before them an important point raised by an order made by Mr. Justice Ridley at Chambers in an action set down for trial by the Umballa Residential Hotel Co., Ltd., to which the County of London Electric Supply Co., Ltd., were the plaintiffs. It appeared that the plaintiff company was incorporated for the purpose of acquiring and carrying on the premises in Coram Street, Russell Square, known as the Umballa Mansions Hotel, then carried on by a married lady, who traded under the name of Miss Mellon. The necessary capital was raised and the property acquired from May 9th, 1906. It then transpired that Miss Mellon was in arrears with her payments for electric light supply, and the defendants, so soon as they became aware that the property had changed hands, set about inquiring whether there was any agreement between the company and Miss Mellon when she went out, regarding their account for supplying electric light, which had been running unpaid since September, 1905. It appeared that there was not. The rights of electric supply companies are regulated by a statute which incorporates the same provisions as to the rights and liabilities of the consumer as does the Act which regulates the supply of gas. Under that statute the incoming tenant is not liable unless he contracted to become so with the outgoing tenant for electric light supplied to the outgoing tenant. In the Electric Lighting Order of 1898, there is a provision that the undertaker shall upon being required to do so by the owner or occupier of premises continue to give a supply of energy for the premises, subject to the condition that—if required by the undertakers—the applicant shall give security for payment of moneys which may become due for electric light. Correspondence took place between the defendant company and the new hotel occupiers, and in the course of that correspondence the Electric Supply Co. intimated that they were willing to continue the supply on a deposit of £25 being made by the applicants. Plaintiffs tendered £20 in gold, and left with the company a demand for supply. The defendants refused to accept that sum as adequate security, and on May 29th the Hotel Co. issued a writ in view of the threats of the defendant company to cut off the supply unless the arrears were paid. It being then the Whitsuntide holidays, an arrangement was made that £25 should be paid to the defendants during the holidays without prejudice to the rights of either party, that being the sum demanded by the defendants as security for the ensuing quarter's supply. There was some dispute as to whether the money was paid as security or deposit. The defendants still threatened to cut off the supply, and the Hotel Co. thereupon brought the action, claiming an injunction to restrain defendants from discontinuing the current for lighting purposes, and a declaration that, having given notice for a supply, and tendered reasonable security, they were entitled to be so supplied as long as they paid the account when due. Plaintiffs applied to Mr. Justice Ridley in chambers for an interim injunction, but that judge refused the application. Hence the appeal of the plaintiffs.

Mr. Montagu Lush, K.C., Mr. H. Simmons and Mr. A. Page appeared for the plaintiffs, and Mr. J. B. Matthews for the defendants.

At the conclusion of the arguments,

The Master of the Rolls said it was clear law that a new tenant of licensed premises was not, in the absence of agreement, liable to pay for gas or electric light supplied to the outgoing tenant, but not paid for at the time of the change. The Electric Lighting Order provided that if the tenant of premises within a certain area from an electric main wished to be supplied, he was entitled to a supply as of right by giving a notice to that effect to the company. The company's liability to supply, however, was in that case limited in this way, that they were not bound to comply with the demand unless reasonable security was found by the person who made the demand. It seemed to his Lordship that what took place was quite consistent with the view put forward by the appellants, that they were perfectly willing that the £25 cheque should be substituted for the £20 offered and previously refused by the defendant company. The sum first deposited, in his Lordship's opinion, was a reasonable amount, having regard to the fact that it was a summer quarter. The defendants, therefore, were under a statutory obligation to supply electric energy to the plaintiffs, who had fulfilled the conditions. In the circumstances, he thought the plaintiffs were clearly entitled to ask for the interlocutory injunction to restrain the defendants from discontinuing the supply. Irreparable damage might be caused to the plaintiffs' business, if, in the London season, the hotel were left in darkness by the defendants carrying into effect their threat to cut off the supply. The rights of the parties could be ascertained fully at the trial, but it was clear that in the interval the defendants ought to be restrained from acting on their views of the rights, which, if they happened to be wrong, would lead to irreparable mischief being done to the plaintiffs' business.

Lord Justice Cozens-Hardy concurred.

The appeal was accordingly allowed, and an injunction in the terms asked was ordered to issue. The sum of £25 which plaintiffs paid to defendants was directed to remain in the custody of the defendants as security for the ensuing quarter's supply.

---

### The Electrical Power Storage Co., Ltd., *v.* Patents Exploitation, Ltd.

In the Court of Appeal, before Lords Justices Vaughan-Williams, Romer and Moulton, on Friday last, the hearing was concluded of this case on the appeal of the defendants from the judgment of Mr. Justice Joyce in the Chancery Division. The facts of the case as stated at the previous hearing appeared in the Electrical Review for March 16th, 1906.

Mr. Astbury, K.C., and Mr. Shaw appeared for the appellants, and Mr. Hughes, K.C., and Mr. Graham for the respondents on the appeal.

At the conclusion of the arguments of counsel, Lord Justice Vaughan-Williams, in giving judgment, said it was admitted that the onus was upon the plaintiffs to establish their right in the events which had happened to have the costs and damages applied in the manner they sought. He was of opinion that the agreement did not in any way refer to the Court of Appeal or to the House of Lords. He thought, therefore, that the appeal should be allowed.

The other Lords Justices concurred, and the appeal was accordingly allowed with costs.

---

### Markt Bros. & Co. and the Auto-Claw Co., Ltd., *v.* Messrs. F. Krasa & Co.

In the King's Bench Division on Monday, before Mr. Justice Phillimore, Messrs. Markt Bros. & Co. and the Auto-Claw Co., Ltd., sued Messrs. F. Krasa & Co., of 7, Wood Street Square, London, for £65 10s. damages, alleged to have been sustained by reason of defendants' failure to deliver some 179½ gross pairs of fuse bases and clips in accordance with contract. Defendants pleaded that they simply accepted plaintiffs' order as the agents of Mr. L. Pohl, of Tellnitz, Bohemia, and subject to his confirmation, and that he was, in fact, the principal to the contract.

Mr. Gore Brown, K.C., and Mr. A. H. Spokes were for the plaintiffs, and Mr. McCall, K.C., Mr. Hansel and Mr. Haslam appeared for the defendants.

After hearing evidence and counsels' arguments, Mr. Justice Phillimore said he had come to the conclusion that the contract was one between plaintiffs and defendants as principals, and he gave judgment for plaintiffs for £51 17s. and costs.

---

### An Apprenticeship Case.

At the Bradford County Court on 3rd inst., the Rhodes Electrical Manufacturing Co., Ltd., Bradford, sued John Barker for breach of an agreement which had been entered into by the defendant that his son Percy should serve a six years' apprenticeship to plaintiffs. On behalf of the plaintiff company it was stated that in October, 1902, the defendant had arranged with the Rhodes Electrical Manufacturing Co. that his son Percy should serve an apprenticeship from October 28th, 1902, until June 25th, 1908. A premium of £52 10s. was paid, the apprentice to receive a varying salary until the completion of his servitude, the maximum amount being 10s. per week. The apprentice remained at work until March 16th last, the reason he assigned for leaving being that he was not being taught his trade as provided by the agreement. When the apprentice left the firm's employ he was in receipt of 6s. per week, and the person engaged to perform his work was paid 14s. per week. It was to recover this excess in wages that the damages were asked for. J. W. Axworthy, the works manager, for the plaintiff company, gave evidence in support of Mr. Greenwood's statement, pointing out that the apprentice had been placed in various departments at different times, and had been provided with opportunities of familiarising himself with the methods of brass finishing, winding, casting, mechanical and testing branches.

For the defence it was urged that the apprentice had not been allowed due facilities for learning his trade. In support of this contention, Percy Barker gave evidence, and stated that he had only been taught the manufacture of the brush part (a comparatively simple one) of the electrical mechanism. He had been called upon to perform the ordinary routine of office work, which included sweeping up and the running of errands. When he complained that a premium apprentice was being treated in this manner, he was informed that he would be put back into the engineering shop.

His Honour gave judgment for the amount claimed.—*Yorkshire Daily Observer.*

---

### Otto Electrical Manufacturing Co. (1905).

The *Financial Times* reports that on 3rd inst. Mr. Justice Buckley, in the Chancery Division, was asked upon a summons of the liquidator of this company to decide the question whether the company could, before commencing business, bind itself by any contract. Mr. Coldridge, for a creditor (Mr. A. C. M. Jenkins), said the company was registered on May 26th, 1905; a prospectus was issued to the public, but the response was small, and the company did not go to allotment, and therefore never became entitled to commence business. Mr. Jenkins had before this supplied money for preliminary expenses. His Lordship made an order declaring that, as the company was never entitled to commence business, any contract made by the company was not binding on it, and that Mr. Jenkins's claim must be disallowed.

# BUSINESS NOTES.

**Overhead Equipment Tester.**—Messrs. Everett Edgcumbe & Co., Ltd., of Collindale Works, Hendon, N.W., have recently put upon the market a new overhead testing equipment, which is shown in the accompanying illustration. It is intended to afford a simple and efficient method of detecting faulty overhead insulators. It has been devised in conjunction with Mr. A. H. Pott, of the Metropolitan Electric Tramways Co. The test is made from the car itself without its being necessary to make a special trip for the purpose. The apparatus consists, as will be seen, of a light aluminium frame which is clamped to the boom, and carries a wooden cross arm pivoted at its centre. This arm carries at each end a light steel spring of special shape, which, as the car travels along the route, makes momentary contact with each span wire, as shown in the illustration. The pivoted arm also carries a small fork fitting round the trolley head in such a way that, however

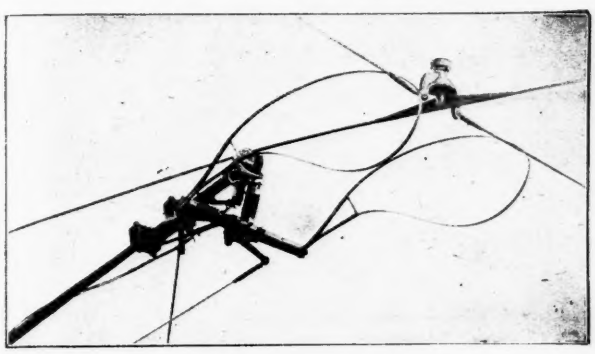


Fig. 1.—Testing Overhead Equipment.

much the latter turns from side to side, the cross bar always remains accurately at right angles to the trolley wire. This condition is fulfilled even when the boom swings right out to the side of the car, and at the same time there are no projections which can catch in the overhead construction. Provision is also made for lowering the contacts and so instantly putting them out of action should it be so wished. The usual speed at which a car is run during the test is seven miles per hour, but there is practically no limit in this direction, so that no special trip need be made. A common practice is to send out the apparatus on the first car travelling along each route every day or every seven days. The method of carrying out the tests is shown diagrammatically in figs. 2 and 3. Fig. 2 shows the test of insulator A. Should the latter be faulty and the span wire thereby be made alive, the detector connected between the contact spring and earth will show a deflection, as the trolley

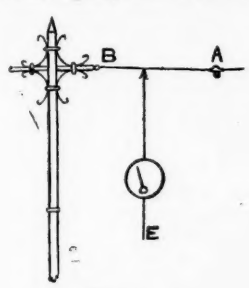



Fig. 2.

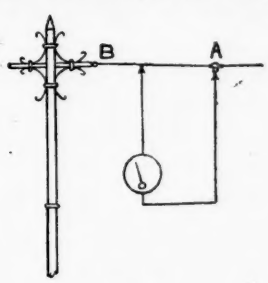



Fig. 3.

passes under the faulty insulator. With the connections made as shown in fig. 3, if the insulator B is faulty, a current will flow from the trolley wire through the detector to the span wire, and thence to earth through the faulty insulator and the pole. The detector consists of a special moving-coil instrument designed to withstand rough handling and vibration. It is scaled 0-600 volts, and can, therefore, be employed as a double-range voltmeter. In order to increase the sensitiveness, for the purpose of the overhead test, it is provided with a spring key which when depressed increases the sensitiveness five times. The instrument is also provided with a direct reading insulation scale to 10 megohms, so that it can be at any time employed as a direct-reading ohmmeter for general testing purposes. For the overhead test, a compact change-over key is fitted whereby either the A or B insulators can be tested at will without any alteration being required in the connections. The instrument terminal marked E is to be connected to "earth" (*i.e.*, to the body of the car). The other terminal is only required when the instrument is used as a voltmeter or ohmmeter apart from the overhead tester.

**Toronto Electrical Workers' Strike.**—This dispute, after lasting about a week, has been settled, all the firms having come to terms with the strikers, who are now receiving 35 cents an hour instead of 27½ cents, as formerly.

**Consular Notes.**—Brazil.—In view of the great opening at present existing in Brazil for the extension of electrical enterprise, considerable importance may be attached to the report of the British Consul at Rio Grande do Sul, recently issued, in which he reminds British merchants and manufacturers that if they are desirous of pushing the sale of their goods in the State they must conform to the methods necessary to secure a footing. It is quite useless to content themselves with sending price lists and catalogues in the English language, currency, weights and measures, to the Consulate and expect that business will result. The Consul is always ready to distribute these, but the English language is practically unknown in the State and is useless as a medium of trade. All catalogues, &c., should be in the Portuguese language with metric weights and measures, and local currency prices subject to the fluctuations of exchange. Again, British merchants will be well advised not to consign their goods to order on commission. The general conditions in the State are not favourable for this form of business. This is not intended to apply to cases where a business of this kind is already established with well-known customers. It is only meant as a caution to the numerous merchants and manufacturers at home who appear to think that orders will result from a mere distribution of circulars. There is only one way in which a satisfactory business may be developed by new aspirants, and that is by the employment of travellers speaking the Portuguese language, well equipped with samples, able to study the conditions of trade on the spot and empowered to make all the necessary financial arrangements. The most important matter for British merchants to get a thorough grasp of before embarking upon any venture is the customs tariff and the regulations that accompany it. Full information can no doubt be obtained from the nearest Brazilian Consul or the Commercial Intelligence Branch of the Board of Trade, 73, Basinghall Street, E.C.

Venezuela.—The British Consul at Caracas in a recent report states that an important work in which British enterprise and capital are largely concerned, has been commenced by the conclusion of a contract between a group of British capitalists and the National Government, by which the right to run electric trams in the city of Caracas is conceded for a period of 99 years. The three small native companies have recently been purchased, and the lines are to be electrified. The work should commence within a few months, and will be carried out by a New York and London firm of contractors. The system will be the overhead trolley, with 90 lb. rails and a 3½ ft. gauge; about 12 miles of track will be laid for the present. Power will be supplied by the Native Electric Power Co., whose hydraulic generating station is established at a distance of some 12 miles from the city, and it is proposed to install a Diesel oil engine (between 500 and 600 H.P.) for reserve purposes. The present horse cars only carry 2,000,000 passengers annually. The population of Caracas is about 70,000. The conversion of the existing telephone system to central battery is shortly to be undertaken. The company is British, with its principal exchange in Caracas, connected by trunk lines with the important towns and villages in the centre of the Republic. The alteration is expected to cost £25,000. The Consul is informed by the managers of the above undertakings that in spite of their wish to purchase their material in the United Kingdom, the class of goods offered to them and the undue delay which ensues before delivery (amounting, as it does in some cases, to more than six months), forced a decision in favour of the United States, where the goods are cheap, of sufficient quality, and are delivered within about three weeks of their ordering by cable.

**Siemens Brothers & Co.**—The Berlin *Tageblatt* refers to the new arrangement made in the English sphere of interest of the Siemens & Halske Co. The firm of Siemens Bros. & Co., Ltd., the English representatives of the Siemens concern, has been divided into two parts. The division has been undertaken in so far that Siemens Bros. retain in their own administration the light electrical engineering department and cable-works at Woolwich, while the heavy electrical engineering works at Stafford have been entrusted to a special organisation in the form of a new company under the title of Siemens Bros. Dynamo Works Co., which took over the business as from January 1st, 1906. As to the capital of the new company, it has been arranged to provide £200,000 in bonds in the first place. The share capital will be fixed just as high as the surplus of the brought-in assets exceeds the liabilities of the new undertaking, plus the amount of the £200,000 in bonds, and on this basis the share capital will be approximately £300,000. The Berlin newspaper adds that the object of the new arrangement is to simplify business relations between the Siemens-Schuckert Works Co. and the English company. This is to be attained by the English heavy electrical engineering department, with which the Siemens-Schuckert Works mainly work, being formally independent. The whole of the £200,000 in shares and £300,000 in bonds will remain in the possession of Siemens Bros. & Co., Ltd.

**Trade Announcements.**—Messrs. Isaac Bentley and Co., Ltd., announce that they have now removed to the offices at their new works, and all communications should be addressed to "Vinoleo" Oil Works, Trafford Park, Manchester.

Mr. E. A. Brandon announces that he has relinquished his appointment as sales manager to Messrs. Johnson & Phillips, Ltd., of Old Charlton, in whose service he was for nearly 14 years, and is now established at 55, Barbican, E.C., as London representative for Mr. T. W. Broadbent, Victoria Electrical Works, Huddersfield; Messrs. Foster & Co., of Wimbledon, S.W.; the Simplified Underground Conductor Co., Ltd., of Liverpool; the Switchgear Co., Ltd., of Birmingham; and Messrs. W. O. Rooper & Co., of Stafford.

The A.B.P. Accumulator Co., Ltd., have removed their London office from 47 to 39, Victoria Street, S.W.

Lord Justice COZENS-HARDY concurred.
The appeal was accordingly allowed, and an injunction in the contract made by the company was not binding on it, and that Mr. Jenkins's claim must be disallowed.



Mr. CHARLES G. TREVETT, who has been in business for several years in Cape Town as an electrical engineer, has just opened a branch office and showroom at 37, Oxford Street, East London, Cape Colony. The branch in question is under the management of Mr. E. A. Shaw, who was with Mr. Trevett in Cape Town for nearly two years, and previously had charge of the electric light department of Messrs. C. Findlay & Co.

The CHLORIDE ELECTRICAL STORAGE Co., LTD., have opened a new branch office at Standard Buildings, City Square, Leeds, under the management of Mr. L. Broekman.

MESSRS. J. BURNS, LTD. ("Delaware" vulcanised fibre) announce that having disposed of their interest in the lease of their Little Britain premises under a street-widening and rebuilding scheme, their address is now 189, Central Street, London, E.C.

The MIRRLEES WATSON Co., LTD., of Glasgow, announce that their works are closed for the Annual Fair holidays from yesterday (July 12th) until Thursday next (July 19th). The offices will be closed on 14th and 16th inst. only.

The SUNBEAM LAMP Co. have opened very fine show-rooms at 19-21, Northumberland Street, Newcastle, for the supply of Sunbeam lamps and electrical appliances of every description and of the latest and most up-to-date designs. The new Infirmary opened by the King and Queen this week, is supplied throughout with Sunbeam lamps. The company are making large developments in connection with their North of England trade, and Mr. James Gledson, until comparatively recently superintendent of the Edison and Swan Co.'s North of England branch, has been appointed manager of the new Sunbeam branch in Newcastle.

MESSRS. PORTABLE ACCUMULATORS, LTD., wish to notify users of electric batteries that they have a large staff of competent workmen at their works at 141, Much Park Street, Coventry, and 210, Shaftesbury Avenue, London, W.C., who are able to undertake repairs to any make of accumulator.

MESSRS. BERTRAM THOMAS, of Hulme, Manchester, ask us to state that Messrs. Nursey & Marr are no longer their London agents, the connection having been severed.

MESSRS. SEABROOK BROS., of 32-34, Featherstone Street, City Road, E.C., have opened an electrical department for the sale of "American" electrical specialities, concerning which they have just issued an illustrated price list. This gives particulars of "Kenco" battery motors, small toy motors, "Kenco" battery fans, Knapp electro-medical appliances, electric railway and tramway models, Gordon batteries, &c. We understand that after expert tests the Gordon batteries are to be supplied with their motor fans.

**Brush Contracts.**—The following contracts have been recently secured by the BRUSH ELECTRICAL ENGINEERING Co.:—

For the County of Durham Electric Power Distribution Co.—500-KW. turbo-generator.
For the Pontypridd U.D.C. (per B.T.-H. Co.).—Eight car bodies.
For the Buenos Ayres Great Southern Railway.—Two 1,000-KW. turbo-alternators, one 500-KW. Brush reciprocating engine and alternator.
For Rangoon (per B.T.-H. Co.).—Five bogie car bodies, five single-truck car bodies.
For the North Metropolitan E.P.S. Co.—One 1,500-KW. steam turbo-alternator and condensing plant; four 150-KW. transformers.
For the South Hetton Colliery (per Mr. D. Selby Bigge).—Three 625 K.V.A. transformers; also one of 312 K.V.A. and one of 25 K.V.A.

**Book Notices.**—"Telephones and Telegraphs, 1902." Special reports of the U.S. Department of Commerce and Labour. Washington: Bureau of the Census.

"*Question Box* of the Twenty-ninth Convention of the National Electric Light Association." Edited by Paul Lüpke. Meeting of June 5th to 8th at Atlantic City, N.J.

"Transactions of the Illuminating Engineering Society." Vol. 1, Nos. 1, 2 and 3. New York: Illuminating Engineering Society. 50 cents per copy.

"A Technological and Scientific Dictionary." Part XIII. Edited by G. F. Goodchild and C. F. Tweney. London: George Newnes, Ltd. 1s. net.

"Herzogliche Technische Hochschule Carolo-Wilhelmina zu Braunschweig." Programm für das Studienjahr, 1905-6. Brunswick: F. Vieweg & Sohn.

**Catalogues and Lists.**—MESSRS. ELLIOTT BROS., Century Works, Lewisham.—Very neatly produced and well illustrated souvenir catalogue (56 pp.), telling a good deal about the birth of the business in 1800, and its subsequent great development and progress. Photographic views of the various shops appear, and brief illustrated descriptions of some of the firm's leading electrical manufactures are also included.

The CONCORDIA ELECTRIC WIRE Co., LTD., Queen Street, E.C.—Illustrated price lists of patent tube and pipe-bending machines, magazine fuses, flexible arm brackets and "Outshine" lamps.

MESSRS. CROMPTON & Co., LTD., Salisbury House, E.C.—Illustrated publication (No. P26) in their standard size and style, describing and giving a table of prices of electric projectors, of which they have been manufacturers for the past 20 years, and of which many have been supplied to steamship companies and home and foreign Governments. Their diverging lenses, and the Crompton projector lamp (horizontal type, hand and automatic) are detailed. Particulars are further given, together with a half-tone view, of their portable projectors (with limber) for field service.

MESSRS. MAVOR & COULSON, LTD., Glasgow.—The firm's July date card gives a few particulars concerning the performance of a "Pick-quick" electric coal-cutter working through hitches.

MESSRS. GEIPEL & LANGE, London, S.E.—Illustrated price lists of Vulcan portable ohmmeters and Ward-Leonard field rheostats.

MESSRS. ALFRED HERBERT, LTD., Coventry.—We have received a copy of the firm's 1900 (second edition) Section E catalogue containing well-arranged descriptive matter concerning their various capstan lathes, and standard headstocks, rests, and oil pumps for the same. Shaving lathes for finishing the heads of screws, pins, &c., stud-making lathes, chucks, capstan lathe tools are also particularised, some pages of illustrations appearing of examples of work done with their machines. A table of cutting speeds is published. A second publication received from Messrs. Herbert relating to their exhibit of machine tools at Milan International Exhibition may be regarded as a fine sample of their usual enterprise. They are one of the few British firms that have taken this exhibition seriously, and we have little doubt that in their particular line of industry they will be well rewarded. The catalogue consists of 110 pages of matter printed in Italian and brightened by a large number of excellently executed half-tone illustrations of their machine tool manufactures. The publication is a fine piece of art printing, and we congratulate the firm upon doing it so thoroughly.

The A.B.P. ACCUMULATOR Co., LTD., Stockton-on-Tees.—Three new storage battery price lists. They contain illustrations, also output, weight and dimensional data of A.B.P. batteries for (*a*) train lighting, (*b*) yacht lighting, and (*c*) central station and private lighting.

GENERAL ELECTRIC Co., LTD., London, E.C.—An eight-page booklet has been compiled relating to the "Freezor" electric fans, illustrating a number of types and stating prices. These booklets are prepared without name for the convenience of the trade, to whom quantities will be sent on application.

BONNAUD WATERPROOF TEXTILES AND PAPERS, LTD., Ponder's End, N.—Price-list of water, steam and acid-proof driving belting.

Mr. A. H. HUNT, Cannon Street, E.C.—Illustrated catalogue (22 pp.) devoted exclusively to Hellesen's dry cell ignition batteries for use in conjunction with explosion motors of all kinds. Many types are shown, and instructions are given concerning the selection and use of dry batteries for cycles, cars, boats and stationary motors. Prices, also dimensional and weight particulars, are included, as well as instructions for making connections. Mr. Hunt is the sole agent for Great Britain for the Hellesen cells and batteries. Other circulars received from him relate to "Clutch" insulating tape and automobile flexible wires.

MESSRS. WARD & GOLDSTONE, Manchester.—Four-page circular giving prices, particulars and illustrations of table and bracket fans for A.C. and D.C.; also port-hole and box-blade ventilating fans.

**New Reflector Lamp.**—An aluminium reflector of special shape has been devised by Mr. E. CHAMBERLAIN (the "Everbryte" Lamp Co.), of 35, Claremont Square, Islington, London, N. The reflector can be had separately, but is also supplied with a lamp of special shape, to which it can be securely fixed. The reflector concentrates the light in the vertical direction, whilst permitting a sufficient amount of light to pass in the horizontal direction for general illumination. The Everbryte reflector weighs less than 1 oz., and is very neat, does not tarnish and cannot be broken. The lamps are of English make. According to a test made at the Westminster Electrical Testing Laboratories, a 200-volt 16-C.P. Everbryte lamp, giving 22·4 C.P. maximum horizontal and 7·9 C.P. vertical without reflector, gave 74·5 C.P. vertical with the reflector, taking 59·7 watts.

**Strike at Wolverhampton.**—The iron moulders employed by the ELECTRIC CONSTRUCTION Co., LTD., Bushbury, and by MESSRS. THOMAS PARKER, LTD., Wolverhampton, came out on strike on Friday last week, in order to enforce higher wages. For some time the men have complained that, whereas the rate of pay in Birmingham is 38s. a week, in Wolverhampton it is only 32s. For several weeks the Wolverhampton branch of the Ironworkers' Union has been in communication with the Ironmasters' Federation with a view to obtaining 2s. a week, thereby bringing up the wages to 34s. The masters stated that they were willing to grant 1s. increase now, and to consider the question of giving another 1s. in six months' time if the state of trade warranted it; but the men not being satisfied with this, have come out on strike. There are over 100 men in the local branch of the union, but 80 only are affected, and the majority are engaged at the works of the E.C.C. The union men have succeeded in bringing a number of the non-union men out with them. The latter have since, however, returned to work.

**Dissolutions and Liquidations.**—GUEST & KEARTLAND, electrical engineers and contractors, 15, Arcade Chambers, Walsall.—Messrs. R. Guest and A. Keartland have dissolved partnership. Mr. Keartland will attend to debts.

BODIE ELECTRIC SYNDICATE.—This company is winding up voluntarily with Mr. R. A. S. Burnham as liquidator.

WIGHT & JONES, electrical and general engineers, High Street, Hornsey.—Messrs. E. Wight and E. W. Jones have dissolved partnership. Mr. Wight attends to debts.

**Annual Outing.**—FERRANTI, LTD., had their annual outing on Saturday last, July 7th, to Llandudno. On arrival, breakfast was partaken of at the Grosvenor Hotel, and afterwards the party proceeded to the Happy Valley, where a photograph of the group was taken. The party then split up into sections, some going for a drive round the Great Orme's Head, others for a sea trip down the Menai Straits.

**Litholite.**—We have received from MESSRS. HUNT AND HESS, of Hackney, a copy of a test recently made at Faraday House upon some Litholite sheets manufactured by them, in comparison with fibre; the results of the tests are of a very satisfactory nature.

**Newcastle Infirmary Installation.**—On Wednesday His Majesty the King opened the Royal Victoria Infirmary at Newcastle-on-Tyne. We learn that Mr. E. R. Dolby, M.Inst.C.E. (Dolby & Williamson), of Westminster, has acted throughout as consulting engineer for the engineering works, which are very extensive, and may be divided as follows:—Steam generating plant; heating, hot water service and cold water supply; electric lighting and electric treatment, telephones and bells; electric lifts; steam laundry; dispensary.

The boiler house is below ground level underneath the laundry, and the contractors for the engineering work were Messrs. Davy Bros., Ltd., Sheffield. The plant consists of three Lancashire boilers, each 30 ft. long × 8 ft. diameter, built for a working pressure of 80 lb. per sq. in. These are fitted with the Ellis-Eaves' system of heated induced draught. In the main flue at the back of the boilers is fixed a large Green's economiser, and in a special chamber at the base of the chimney a rotary fan driven by an electric motor. The chimney is only 80 ft. high.

The contractors for the electric lighting were Messrs. Falconar, Cross & Co., of Newcastle-on-Tyne. Electrical energy is supplied from the public mains of the Newcastle and District Electric Lighting Co., Ltd., on the direct current three-wire system with a pressure of 240 volts between the outer and middle wires. A large number of motors are fed at 480 volts, and the whole of the lighting is carried out at 240 volts. The total number of lamps installed is equivalent to about 4,500 8-C.P., and there are some arc lamps in use in the laundry. The mains are armoured, braided and lead-covered, made by Messrs. Callender's Cable Co., and the wires by Messrs. W. T. Henley's Co. All the wiring is carried out in screwed steel tubing laid in the floors and behind the tiling on the walls, and is accessible by means of inspection boxes. The fittings are of strong and plain design. In the electric treatment department there is a rotary transformer to supply various medical and electrical apparatus. There is a complete private telephonic installation with about 40 instruments, a complete system of electric fire alarms, and a bell system designed for signalling to the medical and nursing staff throughout the building. There are about 70 clocks made by the Synchronome Co., London, and all controlled and actuated from one central clock.

Five electric lifts, built by Messrs. Waygood & Co., Ltd., of London, are installed. That in the nurse's home is of the press button type. Two are bed lifts with switch control, and two serve the kitchen, which is on the top floor of the administration block, and these are used for the dinner wagon service to the wards. The dispensary is fitted with a very complete set of machines by various makers, and these are driven by several electric motors, and the workshop has a set of machine tools also actuated by a motor.

**Paris.**—La Société des Produits Electriques et Metallurgiques des Pyrenees is the title of a company which has just been formed in Paris (55, Boulevard de Sebastopol) with a capital of £240,000.

**Russia.**—The balance-sheet of La Compagnie Centrale d'Electricité, of Moscow, for the last financial year shows a loss of £2,140.

**Condensing Plant.**—The contract for the condensing plant in connection with the utilisation of exhaust steam on the Rateau system installation at the Hallside works of the Steel Co. of Scotland, Ltd., was placed by Mr. Mitchell, of London, with the MIRRLEES WATSON CO., LTD. of Glasgow, the main contract for the installation being placed by the Steel Co. of Scotland with Mr. Mitchell, who has the sole rights in Great Britain for the Rateau system.

**For Sale.**—On July 20th MESSRS. HEPPER & SONS will offer for sale by auction the machinery, stock, &c., of Albert Dickinson, electrical engineer, Wortley, near Leeds. Some particulars appear in our advertisement pages to-day.

## LIGHTING and POWER NOTES.

**Aspull.**—A prov. order for E.L. is being applied for by the Lancashire Electric Power Co.

**Bacup.**—The T.C. has applied to the L.G.B. for a loan of £7,000 for electricity purposes.

**Barnstaple.**—A great improvement in the electric lighting of the High Street has been effected by the substitution for incandescent lamps of miniature arc lamps of 600 C.P. The new lamps are being fitted into the hoods hitherto in use.

**Bodmin.**—Applications for prov. orders for E.L. are being made by Messrs. Foote & Milne and the Western Electricity Supply Corporation (Exeter).

**Brandon.**—The U.D.C. has decided to inquire of the colliery companies in the district if any of them can supply energy for public lighting, and if so, when and upon what terms.

**Brentwood.**—The Electricity Works Development Co. has informed the U.D.C. that it intends applying for electric lighting powers.

**Brighton.**—The T.C. on July 5th decided by 19 votes to 16, to open a show-room for the electricity undertaking. It was denied that the intention was to compete with local tradesmen, as it was not the intention of the Lighting Committee to sell or dispose of a single article.

**Bristol.**—At the annual conference of the Museums Association, which concluded on Saturday at Bristol, "The Lighting of Museum Cases" was a subject introduced by Mr. Thomas White. The President of the Association said he did not agree that arc lights were not satisfactory, and remarked that a plain white ceiling with an arc light gave a light which was as good as daylight.

**Burgess Hill.**—A prov. order for E.L. is being applied for by the Mutual Electricity Supply Co.

**Canada.**—OTTAWA.—The Ottawa Electric Co. and the Ottawa Gas Co. have agreed to consolidate their respective concerns. There will be no change of stock, but, under the agreement, the two companies will work with one executive staff, which will effect a big saving in working expenses.

OWEN SOUND, ONT.—The T.C. has awarded a contract for a 500-H.P. cross-compound condensing Robb-Armstrong Corliss engine to the Robb Engineering Co., of Amherst, N.S., with all the fittings, for $7,951, while Messrs. Reid & Kilmer, of Toronto, agents for the General Electric Co., were awarded the contract for an A.C. generator of 375 KW., with switchboard and fittings, for $6,600.

WINNIPEG.—As a result of the recent voting, the townspeople of Winnipeg have approved of the establishment of a civic electrical power plant at a cost of $3,500,000.

**Carlisle.**—Mr. H. R. Hooper held an inquiry on the 3rd inst., in respect to the application of the T.C. to the L.G.B. for sanction to borrow £6,070 for the extension of the electricity works. The detailed estimate for the extensions was as follows:—Battery, 260 cells, £2,450; reversible booster, £400; motor-generator, £400; switchboard and connections, £550; buildings, £900; spare armature, £250; two ventilating fans, £50; total, £5,000; contingencies, £500. The balance of the £6,070 sought to be borrowed was for capital already expended on machinery, arc lamps, &c. The inspector was informed that after six years' working, there had been a loss of £8,000 on the works, which had been met out of the rates. One of the objects of the extension, it was stated, was to provide for pumping the sewage at the bacteria works, but it appeared that the cost of providing this power had not been considered. The inspector said there had been the loss mentioned, and some of the plant, he was told, was out of date, or not efficient, and the Council was going to supply more energy at a price not yet fixed. Whatever the price was, it would be high, and whether it compared favourably with other means of pumping, did not appear to have been considered. It did not seem to be a businesslike proceeding. He added that the battery cost would have to be repaid in 10 years. The inspector later said he must have definite statements. It was only by saving every little thing, and running the works as economically as possible, that it could pull up. There is no depreciation or reserve fund yet provided. The item of £250 for spare armatures would have to be struck off, for spare machinery would have to be bought out of revenue. There was no opposition at the inquiry.

**Chertsey.**—Three companies—the Camberley Electric Supply Co., Messrs. Foote & Milne and the Mutual Electricity Supply Co.—are applying for prov. orders for E.L. in the R.D.C. area.

**Chippenham.**—The Western Electricity Corporation has informed the U.D.C. that it intends applying to the B. of T. for a prov. order for E.L.

**Continental Notes.**—GERMANY.—The Baroper Walzwerke Gesellschaft, of Barop, Westphalia, has decided to put down an electric power plant for the operation of its iron and steel rolling mills.

The municipal authority of Metz is to invite tenders for the extension of the E.L. station at an estimated cost of £11,650.

ITALY.—The authority of the Province of Cosenza has granted a concession for a plant to be put down to utilise the water-power of the River Ampolino in the generation of energy required for the operation of an electric railway between Silana, Cosenza and Cotrone.

**Durham Collieries.**—The Durham Collieries Electric Power Co. intends erecting overhead transmission lines from its power station at Philadelphia for the supply of electrical energy to various collieries in the neighbourhood, and the scheme has been arranged by Messrs. D. Balfour & Son., consulting engineers, of Newcastle-on-Tyne. Sanction from the Houghton-le-Spring R and U.D. Councils, the Hetton-le-Hole U.D.C., and the North-Eastern Railway Co., to the placing of the overhead line over public roads, footpaths and railways respectively, subject to proper precautions being taken, has been obtained.

**Egham.**—Messrs. Foote & Milne, the Mutual Electricity Supply Co., and the Egham Electric Supply Syndicate are applying for prov. orders for E.L. in the U.D.

**Erdington.**—The U.D.C. has decided to take energy for the tramways from Aston Manor T.C. at 1½d. per unit for a term of 21 years, with a minimum consumption of 250,000 units per annum.

**Friern Barnet.**—Messrs. Foote & Milne have notified the U.D.C. that they intend applying for a prov. order to supply electricity in the district. The Council has a provisional order which has been extended.

MESSRS. ALFRED HERBERT, LTD., Coventry.—We have received a copy of the firm's 1900 (second edition) Section E catalogue con-

nature.



**Gillingham (Kent).**—It was stated at the last meeting of the T.C. that there was a deficit of £521 on the working of the electricity undertaking for the year ended March 31st, 1906. A sum of £5,000 had been paid to principal and interest on loans, and nearly £1,000 for a new boiler.

**Herne Bay.**—Three companies are applying for prov. orders for E.L.

**Holbeach.**—The Mutual Electricity Supply Co., Ltd., has informed the U.D.C. that it intends applying for a prov. order for E.L.

**Huntingdon.**—An application for a prov. order for E.L. is being made by the Electricity Works Development Co., Ltd.

**Lancashire Electric Power Co.**—At a meeting of the Worsley U.D.C. on Monday last, a notice was read from the Lancashire Electric Power Co., stating that it was the company's intention to apply for a prov. order in the session 1907. The reason for this decision was explained by the attitude taken up by the B. of T. with respect to the form of agreement for the supply of energy. The Council resolved to write the company asking upon what terms it is prepared to take over the Council's order or, in the alternative, at what price it is prepared to supply energy in bulk.

**Lincoln.**—The T.C. has received sanction for a loan of £13,000 for electricity purposes.

**London.**—ISLINGTON.—The Finance Committee of the B.C., in a report circulated last week, states that the result of the year's working is highly satisfactory, and draws the following comparisons between the years 1902-3 and 1905-6:—The number of units generated has increased from 3,002,292 to 4,077,219. The units sold for power and for day supply have increased from 76,673 to 629,906. The running costs have shown a steady decrease from 2·70d. to 1·81d. per unit. The total costs have decreased from 4·44d. to 3·13d. per unit, including all charges for loans and interest. In this connection it should be noticed that, notwithstanding that additional money has been borrowed, the charge for interest and repayment has decreased from 1·74d. to 1·31d. per unit. The quantity of coal used has increased by nearly 2,000 tons, and the coal bill is actually over £3,000 less. The equivalent number of 8-C.P. lamps connected is 128,765 as against 68,545 in 1902-3.

The Lighting Committee has considered points raised by the borough treasurer with regard to the time allowed for repayment of loans, which is an equated period of 42 years. The Committee recommends, in view of the present position and the future prospects of the undertaking, that the time has arrived when the Council should take steps to make more adequate provision towards meeting necessary depreciation, and that this can best be done by adopting the suggestion of the borough treasurer that in future the period for which money shall be borrowed shall not exceed the estimated life of the object of the loan. The surplus upon the 12 months' working of the undertaking amounted to £14,915, and the Committee, having regard to what it had already stated, considered that this surplus should form the basis of a reserve fund.

SOUTHWARK.—A *résumé* of the accounts of the electric lighting undertaking for the year ending March 31st last has been issued. It is stated that during the 12 months, 110 new services had been laid. The reduction in price to private consumers had reduced the revenue from that source by about £330 for lighting and £170 for power, while the public lighting had benefited to the extent of £410, due to the increase in the number of units supplied. Repairs during the year showed an increase of £165; rates and taxes, £294; and cost of management, £100 (the annual charge agreed upon for establishment expenses not hitherto charged to the undertaking). £2,462 has been paid for interest on loans, and £2,197 for repayment of loans.

HAMMERSMITH.—Application is to be made by the B.C. to the B. of T. to allow the maximum power supplied to the new sub-stations to be increased from 75 to 150 KW.

CITY.—The Tower of London is to be illuminated with electric light, and electricians from the Office of Works have begun their task. It will be several years before the work is completed.

MARYLEBONE.—After considering a report by Mr. A. Wright, its consulting engineer, the Lighting Committee has recommended that Oxford Street, from the Marble Arch to Tottenham Court Road, should be lit by means of 81 flame arc lamps, at an estimated cost of £2,500, and an annual charge for supply of energy and maintenance of £1,675. This has been adopted by the B.C.

**Luton.**—An unopposed L.G.B. inquiry into the application of the T.C. for a loan of £7,000 for E.L. purposes was held last week.

**Lynton.**—The U.D.C. has renewed a 14 years' contract with the local electric light company for public lighting at 50s. per 32-C.P. lamp per annum. The company refused to accept the Council's offer at that rate for a seven years' agreement, requiring 55s. per lamp for the shorter period.

**Maidstone.**—The annual reports of the Maidstone electricity and tramway undertakings are generally satisfactory. Although the tramway profit has fallen to £474, and the receipts show no tendency to rise, the electricity supply department shows a net profit of £678. During the year 99 new customers were connected, increasing the total number to 569.

**Mansfield Woodhouse.**—The U.D.C. has received from Mansfield T.C. an intimation that it is applying to the B. of T. for a prov. order for E.L.

**Mexborough.**—It has been decided that the profit of £673 on the E.L. undertaking shall be placed to a reserve fund.

**Oldham.**—The electrical department show a loss of £451 on the past year's working. The gross revenue was £32,886, and the expenditure £17,082. The interest on mortgages, payments to sinking fund, &c., amounted to £16,255.

**Portrush.**—The U.D.C. has asked Messrs. Curran Bros., electrical engineers, Belfast, to send a representative to Portrush to discuss the question of the lighting of the town.

**Ravensthorpe.**—A L.G.B. inquiry was held on July 3rd into the application of the U.D.C. for a loan of £2,650 for E.L. purposes. It was stated that the Council proposed to take energy from the Yorkshire Electric Power Co. The chairman of the Mirfield Gas Co. opposed on the ground that the undertaking would be a burden to the ratepayers.

**Romford.**—The U.D.C. has received from the Mutual Electricity Supply Co. an intimation that it will apply for an E.L. order.

**Runcorn.**—Messrs. Crompton & Co. have informed the U.D.C. (which possesses an E.L. order not yet carried out) that they intend applying for E.L powers.

**St. Albans.**—The St. Albans and District Electric Supply Co. has informed the R.D.C. that it intends applying to the B. of T. for an amended prov. order authorising the company to transfer to the North Metropolitan Electrical Power Distribution Co., the undertaking authorised by the St. Albans Rural E.L. Order, 1905.

**Seaton.**—On the 6th inst. the U.D.C. were notified that the Western Electricity Corporation, Exeter, intend to apply during the next session for an E.L. prov. order. It was decided to oppose any application for an order on the ground that it was unnecessary.

**Sevenoaks.**—The Mutual Electricity Supply Co. has given the U.D.C. notice of its intention to apply for a prov. order for E.L. There is already one order in force for the district, but it has not been carried out.

**Spennymoor.**—The U.D.C. has accepted the tender of the Northern Counties Electricity Supply Co. to supply energy for 288 lamps at 44s. each per annum.

**South America.**—The German E.L. Co. has informed the Buenos Aires municipality that it will reduce the maximum charge for lighting as from 1st inst., from 25 cents gold to 20 cents gold per KW.-hour.

**South Africa.**—DURBAN.—The Natal Government Railway has finally accepted the tenders of Messrs. Herbert Davies and Spain, of Durban and Johannesburg, for Sections Nos. 1, 2 and 4, and the British Insulated & Helsby Cables, Ltd., for Section No. 3, for the supply, delivery and erection of plant, &c., in connection with its electric power extension scheme, the same to be completed by April, 1907.

Section No. 1.—Two 750-KW. Willans-Parsons turbo-generators, for a working steam pressure of 150 lb., superheated 80°. The generators are to be three-phase 50 cycles, generating at 6,600 volts, at 1,500 r.p.m. We understand the order has been placed by Messrs. Davies & Spain with Messrs. Willans & Robinson for Bruce Peebles generators. Two surface-condensing plants, with Edwards air-pumps and centrifugal circulating pumps, the condensing water to be pumped from the Bay (¼ mile distant), also necessary pipes, valves, &c. One 200-KW. three-phase motor-generator, from 6,600 volts A.C. to 420 volts D.C., for a three-wire system, with three 15-KW. single-phase transformers, &c.

Section No. 2.—One three-phase switchboard with oil-break remote control switches, containing two machine, four circuit and two motor-generator panels.

Section No. 3.—6¼ miles ·1 sq. in. three-core L.A.S. paper-insulated cable, for a working pressure of 6,600 volts, ½ mile of which will be laid on the bed of the Harbour to supply the Bluff sub-station, for which purpose it is specially armoured and taken to two E.H.T. switch pillars. This cable will be laid in duplicate 3¼ miles each. Four E.H.T. section pillars are to be erected at intervals along the cable route.

Section No. 4.—Harbour Department, Bluff Sub-station.—One H. and L.T. switchboard, containing 11 panels for controlling motor-generators, and distributing 500 volts D.C. and 200 volts A.C. to circuits. Three 300-KW. induction motor-generators, 6,000 volts, three-phase, 50 cycles, to be connected to compound-wound D.C. 550-volt dynamos. Four 10-KW. transformers (oil-cooled), 6,600 volts to 200 volts, for incandescent lighting. One 10-ton overhead traveller (hand worked).

**Stretford.**—A scheme of extension to provide for the increasing demands made on the U.D.C. electricity works is under consideration. The works were enlarged less than two years ago. A new feeder, direct from Longford Bridge to Old Trafford, is to be laid down, in order to meet the demands for power and lighting in that area. Already the Committee are assured of increased custom amounting to £500, and there is an additional service to be laid down for the supply of power to the Manchester Corporation for the extended tramway service in the Stretford and Altrincham direction. This, it is estimated, will take from the Stretford power station energy amounting in value to £900 annually. The feeder to Old Trafford is stated to be urgently required, as the cost of working at present is enhanced by the high voltage needed at the station to provide the Old Trafford supply.

**Stroud.**—A prov. order for E.L. is being applied for by the Mutual Electricity Supply Co.

which has been extended.



**Swinton and Pendlebury.**—A new agreement with the Lancashire Electric Power Co. for the supply of electricity in bulk to the district has been approved by the U.D.C. An agreement prepared a year ago failed to receive the B. of T. sanction, on the ground that it involved a divestiture of the Council's powers under its E.L. order. There is a contract for the supply of the district for five years; the continuance of the agreement beyond that period is optional with the Council. Intending consumers have been lost to the Council owing to the delay.

**Thornhill.**—The U.D.C. has decided to apply for a prov. order for E.L., and to oppose a similar application by the Yorkshire Electrical Power Distribution Co.

**Walmer.**—Messrs. Foote & Milne (who have been in negotiation with the T.C. for leasing the prov. order for E.L.) and the Mutual Electricity Supply Co., have intimated to the T.C. that they intend applying for E.L. powers.

**Wanstead.**—At the meeting of the U.D.C. on July 5th it was reported that the National Provincial Electricity Corporation and the Mutual Electricity Supply Co. intended applying for prov. orders for E.L. Several members expressed themselves in favour of entering into negotiations with some company for a supply of energy, but action on the matter was deferred.

**Warrington.**—The T.C. has reduced the price of energy for motive power as under:—First 1,000 units per quarter, 2d. per unit; beyond, 1d.

**Wath.**—The U.D.C. is negotiating with the Yorkshire Electric Power Co. for a supply of energy.

**West Ham.**—The electrical engineer of the Corporation (Mr. A. Hugh Seabrook) hopes to have the supply to Silvertown started by the end of September. An additional feeder is to be put down from the power station to Warmington Street at a cost of £1,150, and an additional H.T. distributor from the Town Hall to Marshgate Lane, at an estimated cost of £491. The electrical engineer's estimate for coal for the current year was ·35d. per unit sold, as against ·4d. last year, and ·56d. in the preceding 12 months. The actual consumption for the current year will be under the estimate, and the electrical engineer believes that it can be got down to ·30d.; if the men concerned knew that they would participate to a small extent in the saving they effected, by exercising the utmost care and intelligence in the use of the coal the result would be assured. At present the record in the coal costs for the London supply stations is held by Hackney at ·32d. The difference between ·35 and ·30 means £2,000, and Mr. Seabrook's suggestion is that if the coal cost per unit sold reaches ·30 for the year ending March 31st, 1907, the shift engineers and boiler house employés be given a bonus of £50 to be divided between them according to their wages, and a bonus of £5 to the resident engineer, and for every ·01d. below ·30d. an additional bonus of £10 and £1. This arrangement is to be carried out.

**West Hartlepool.**—The accounts for the year ended March 31st last show a gross surplus of £4,868, as against £4,005, an increase of £862 8s 11d. This surplus was almost absorbed in meeting the extra charges for interest and redemption of debt, a further sum of £12,330 having been taken up on loan. After meeting all charges a net surplus of £6 remained. The sum of £500 is placed to a reserve and depreciation fund. The amount that the rates have had to provide in respect of the undertaking since its inception is £8,188. The capital expenditure to March 31st was £82,669. There was an amount overdrawn at the bank of £7,373.

**Wimbledon.**—The T.C. has offered to supply energy in bulk to Malden and Coombe U.D.C. at 2d. per unit, with a revision at the end of 10 years and at the expiration of any subsequent five years, the U.D.C. to repay the instalments of sinking fund and interest of loans contracted to meet the cost of laying supply mains from the generating station to the U.D.C. boundary.

**Windsor.**—Prov. orders for E.L. for the R.D.C. area are being applied for by Messrs. Foote & Milne and the Camberley Electric Supply Co.

**Wishaw.**—After only six months' working the burgh has reduced its price for energy from 3½d. to 3d. per unit, and Mr. E. F. Cox, the engineer and manager, estimates the profit for the coming year at approximately £1,000.

**Wrotham (Kent).**—At a meeting of the U.D.C. on Monday, notice was received of the intention of the Mutual Electricity Supply Co., Ltd., to apply for a prov. order for electric light.

## TRAMWAY and RAILWAY NOTES.

**Belfast.**—The Secretary of the Cavehill and Whitewell Tramway Co. has called attention to the position of the Cavehill line in relation to the Belfast tramways system, and states that, owing to the absence of through running, many people living in the neighbourhood of the company's line are subject to inconvenience. "In view of this, the company has decided that, in the general interest of the public, it would be warranted in applying to Parliament for running powers over the Belfast system, equivalent powers to be conceded by the company over its lines to the Corporation. The company is accordingly instructing its Parliamentary agents to promote a Bill for that purpose." The City Council has informed the company that it has no intention of giving facilities for through traffic, and it will oppose any Bill which may be promoted with that object.

A letter was recently received from the Postmaster-General stating that he considered the sum of £1,250 per annum too high for the conveyance of postmen and telegraph messengers on the tramcars in Belfast, and offering £1,000 a year, with a seven years' agreement. The C.C. resolved that, with the greatly extended mileage and the improved service, the sum of £1,250 was the very least it could accept, and declined to agree to the Postmaster-General's proposal.

**Bury.**—The annual report of the Corporation tramways shows the car-mileage to be 1,057,391 miles; passengers carried, 8,266,537; total revenue, £39,969; working expenses, £20,402. There is a net balance, after paying interest and sinking fund of £3,322; £500 will be given in aid of the rates; the rest is to go to the reserve fund.

**Canada.**—The Provincial Government of Ontario has settled the long-contested right-of-way for the Toronto and Hamilton Radial Railway Co. and the Niagara Power Co. along Burlington Beach close to Hamilton. The Government has granted each of the companies a lease of a strip of land 60 ft. wide in return for an annual rent of $500.

Messrs. T. G. Empie, of New York, and A. W. Taylor, of the W. S. Weeks Co., Edmonton, are endeavouring to obtain a charter from the City Council of Prince Albert, Saskatchewan, for an electric street railway. The company they propose to form would develop considerably more power than would be necessary to operate the system, and it is proposed to sell the surplus to local manufacturers.

**Canterbury.**—The Canterbury and Herne Bay Light Railway (Extension of Time) Order, 1906, has been confirmed by the Board of Trade.

**China.**—The British Consul at Tientsin reports that during last year a Belgian company, which had obtained from the late Tientsin Provisional Government the right to construct a tramway in the native city of Tientsin, laid down this line, and tramway materials to the value of £35,460 were imported.

**Continental Notes.** — SWITZERLAND. — The *Feuille Fédérale Suisse* of June 20th publishes a decree ratifying the convention concluded between Germany and Switzerland relative to the establishment of railway communication between Pfetterhausen and Bonfol. It also publishes a decree granting a concession for an electric railway from Niederbipp to Vieux-Soleure to M. le Notaire Lanz, of Niederbipp; and a decree granting to the municipalities of Mendrisio and Stabio a concession for the construction and exploitation of a standard gauge line between those places.—*B. of T. Journal.*

GREECE.—The tramways in Athens and the Piræus are to be converted into electric lines.

SPAIN.—A group of Catalonian capitalists proposes to carry out works for the construction of an electric tramway from Casa Gomis (Barcelona) to Tarrassa. The electric energy will be supplied from a waterfall in the neighbourhood of the line.

The Societa Electrica Moderna de Jerez has solicited a concession for two lines of electric tramways round Jerez de la Frontera—viz., the Santiago-Estacion and the Alphonso XII-Parque. Another concession has been applied for, for the construction at Grenada of an electric tramway from the port of Monachil to Alhama.

Work has been commenced on the substitution of electric for horse traction on the Murcia tramways.

A company is being formed in the province of Navarra for the purpose of constructing an electric railway from Peralta to Marcilla. The electric power will be furnished from a water-mill which has been purchased in Marcilla.

The Sociedad del Tranvia de Estaciones y Mercados, of Madrid, has received a concession for the construction of an electric tramway from the Calle Caridad to the Ramona de la Presilla.

GERMANY.—An extensive examination of a scheme for the conversion to electric traction of the Berlin city and suburban railways is being made at the Ministry of Public Works, where Minister Breitenbach is said to have sympathy with the proposal. It is declared that after a final decision in the matter the work will only be proceeded with gradually, and, in point of fact, the suburban lines will first be taken in hand, so that the completion of the work will occupy several years. As to the system likely to be selected for adoption, it has been found from the experiments on the Spindlersfeld line that single-phase alternating current, with an overhead conductor, has proved superior to continuous-current motors and surface conductors, as in the case of the suburban lines to Zehlendorf (the Wannsee railway) and Gross Lichterfeld-Ost. The adoption of the single-phase method for the Hamburg-Altona Junction line will enable further experience to be gained from this system. But the Berlin ideal of rapid transit—of trains composed of twelve coaches of a total length of 200 metres, and giving a two-minutes' service—could only be accomplished on the city railway at a considerable outlay, owing to reconstruction works and with an interruption in traffic for months, as the platforms are only 120 metres long, and would necessitate extensions and increase in the height. It would be possible to run eight-coach trains, which would allow of twice as much traffic being handled as at present, and the cost of executing this scheme is

were connected, increasing the total number to 569.

the Mutual Electricity Supply Co.



estimated at £3,500,000. The indecision of the State railway authorities renders it probable that years will elapse before the conversion of the railways in the capital to electric traction will be definitely embarked upon.

**Dartford.**—Messrs. J. G. White & Co. having stated that they were not disposed to enter into any binding agreement as to the proposed extension of the tramways to Galley Hill, unless they were granted a long lease of the whole system, the U.D.C. has decided to apply for the necessary powers independently of the lessees. The Swanscombe P.C. will support the application.

**Erdington.**—Work in connection with the construction of the electric tramways and the paving of the carriageways between the tramways and the kerbs has been commenced. The contractors are Mr. George Law, of Kidderminster, for the permanent way and paving, and Messrs. Blackwell & Co., for the overhead equipment. The joint engineers are Mr. Robert Green, Birmingham, and Mr. H. H. Humphries, the engineer and surveyor to the Erdington Urban District Council. The accepted tenders for the work amount to £57,523.

**Gainsborough.**—The R.D.C. has decided to oppose the application for the Gainsborough and District Light Railway Order. The U.D.C. is also opposing.

**Gorton.**—Manchester T.C. has informed the U.D.C. that it is prepared to lease the tramways when constructed. The system will connect Stockport with Reddish, Gorton and Openshaw.

**King's Norton.**—The U.D.C. has decided to acquire for £26,000 the tramways within the district.

**London.**—HIGHGATE.—The inquest in connection with the Highgate tramcar accident was resumed on Tuesday last at the Islington Coroner's Court. The driver, E. Cone, said that the hand brakes failed to act, and when he applied the magnetic brake that also failed, because the wheels were skidding. He believed the brake handle was reversed, and that the car went down the hill without any brake on at all. Mr. Pott, recalled, said that he examined the car, and found flats on only two wheels, so that some of the wheels must have been free. There was nothing to show that the brakes were not in good condition. W. E. Day, a motor inspector, said that he found the reversing lever in the reversed position, in which the brake would not act, and the magnetic brake on the sixth notch —its full extent. He took the car back to Finchley and found that both the magnetic and the hand brakes acted without causing the wheels to skid. Mr. E. Hammond, traffic manager, stated that there were three complaints against the car for stiff brakes and flats on the wheels. The jury's verdict was to the effect that the accident was caused by the wheels skidding and the brakes failing to act when applied without due skill by the driver, who did his utmost to stop the car, but was insufficiently trained.

METROPOLITAN DISTRICT RAILWAY. — Last week the Railway Department of the B. of T. published a report by Major J. W. Pringle into the circumstances attending the fracture of two axles, which led to the partial derailment of electric passenger trains on the Metropolitan District Railway on March 12th. Major Pringle states that the loads which he found were not at all uncommon, and the axles might have been expected to last 20 years or more. His conclusion, after considering all the cases of breakage that had occurred, was that the fracture of the two axles on March 12th was the result of gradual failure, and that the initial cause was the insufficient size of the axles at the wheel seat. It was evident that the solid type of axle adopted by the Underground Electric Railways Co. for the electric stock of the District Railway was not strong enough to stand the heavy stresses experienced under the trail trucks of motor-cars, and a heavier type of axle was required for those trucks. It was hoped that before the end of the present month the whole of the axles of the trail trucks of motor-cars would have been permanently replaced by axles of the new and heavier type. While the new axles were being made and fitted the company had arranged, as a temporary measure, to replace all the old axles in trail trucks of motor-cars with new axles from other stock.—*Morning Post.*

L.C.C.—At a meeting of the Council on Tuesday it was decided to approve an estimate of £500 in respect of preliminary expenses in connection with the acquisition of the undertaking of the London Southern Tramways Co., and to enter into an agreement with the company for the purchase of its undertaking on October 1st, 1906, on the basis of a compulsory sale, as arranged with the company. The Council also resolved to authorise the Highways Committee to conduct the negotiations and deal with the arbitration, if any should take place. The Finance Committee, in reporting on the question, stated that the purchase of the lines was in the interest of the Council's tramways as a whole. Satisfactory financial results could not be expected so long as the lines were worked by horse traction, and the Committee expressed the opinion that the reconstruction for electric traction should be carried out as soon as practicable.

**Mansfield.**—On Saturday evening, about 7.30, a tramcar was being taken up a hill when it commenced to run back and came down with terrific force, crushing into an empty car. The driver of the runaway and the conductor of the other car were injured. The impact took both cars on to the Market Place, where two others were standing, and from which children were descending. Tramway Inspector Lewis bravely jumped on the foremost car and quickly applied all the brakes, which greatly lessened the speed and reduced the force of the collision.

**Paraguay.**—The British Chargé d'Affairs at Asuncion reports that it is stated that electric traction is shortly to be introduced on the present urban tramway, which is owned by a British company. Means of transport are greatly lacking in Paraguay. The Central Railway runs from Asuncion to Villa Rica, and has an extension to Pirapo, in all a distance of 155 miles.

**Penarth.**—The local tramways syndicate has informed the U.D.C. that it intends applying for powers to construct electric tramways in the town. As no plans have been submitted, the Council has reserved its decision as to supporting the scheme.

**South Lancashire.**—Still another section of this ever-expanding system was inaugurated last Friday, when the new length from the Leigh end of Lowton to Lowton St. Mary's railway station was opened for traffic. This is another stage nearer Newton-le-Willows, from which town to the terminus at Lowton St. Mary's a motor-'bus plies for passengers. Meanwhile, the joining up of the lines from Swinton with those already laid and working from Farnworth to Walkden, and the laying of the lines between Winton, Worsley and Boothstown, are proceeding apace.

**Southport.**—An important movement is on foot to connect Southport, Lytham, St. Annes and Blackpool. It is probable that on the Lytham side the trams will join the mainland after crossing the Ribble at a point in Marton.

**Sunderland.**—At an inspection made by Colonel von Donop, B. of T. inspector, the extension of the Sunderland District Tramways system from Hetton-le-Hole to Easington Lane, recently completed, was approved. With this extension there are now 14½ miles of the system fully open, extending from Sunderland, *viâ* Ryhope, Philadelphia, and Houghton-le-Spring to Hetton-le-Hole, with branches to Fence Houses and Penshaw Stations. The power for the tramway system is now being taken from the Durham Collieries Electric Power Co.'s large station at Philadelphia. The inspector was accompanied by the engineers, Messrs. D. Balfour and Son, of Newcastle, and Mr. H. S. Watkins, assistant tramway manager, and others.

**Watford.**—The Light Railway Commissioners last week held an inquiry into the application of Herts C.C. for an order to authorise the County of Hertford to construct the Watford Light Railway, and to extend the time for carrying out the Bushey and Barnet Light Railway Order. It was stated that the proposed systems would connect Watford with London, and that the Bushey scheme would cost £47,000, and the Watford scheme £25,000. The last named was to be leased after construction to the Electric Tramways Co., who would pay 4½ per cent. interest on the capital. There was some opposition on the ground that tramways would ruin the residential aspect of the neighbourhood, but the order was granted, together with the extension of time asked for.

**Wednesbury.**—The T.C. has approved of an agreement between Walsall T.C. and the South Staffordshire Tramways (Lessee) Co., for a through tramway service between Walsall and Wednesbury.

**West Ham.**—The borough engineer is to be directed by the Corporation to undertake the construction of the permanent way and the tramways manager the overhead equipment, for the purpose of connecting up the Leyton tramway system with the Council's system in Woodford Road. According to a report circulated on Monday the total cost of the works executed in connection with contract No. 2 of the Corporation tramways was £40,960. The original contract was £27,650. There were additional works to the amount of £12,079, and extras of £2,310. There were credits for old material.

**Yorkshire.**—The Dewsbury and Ossett Corporations and the Soothill Nether District Council have entered into agreements with the National Electrical Construction Co. for that company to construct and work a line between Dewsbury and Ossett.

The Pudsey Corporation is actively negotiating with the Leeds and Bradford Corporations for tramway connections between Pudsey and the two cities.

**York.**—The T.C. has resolved to reopen negotiations with the General Tramway Co. for the purchase of the tramway undertaking in the city. It will be remembered that former negotiations were dropped because of the large sum mentioned by the company, the intention of the Council being to resume negotiations when the expiration of the lease drew nearer.

## TELEGRAPH and TELEPHONE NOTES.

**Cable Steamers of the World.**—The *Archiv für Post und Telegraphie* points out that the fleet of 53 cable steamers now aggregates 95,000 tons and 25,000 H.P., and that of the number, two are owned by Germany, five by North America, two by South America, one by China, three by Denmark, six by France, 30 by Great Britain, and one each by Italy, Japan, New Zealand and Holland.

**Glasgow.**—The T.C. last week decided to sell its telephone system to the Government for £305,000.

**New Telegraph Stations.**—The Portuguese Colonial Administration officially announces the opening to public service of new telegraph stations at Lurio, Porto Amelia, Quissanga, and Ibo in Nyassaland. The German Administration also announces the opening of new offices at Kappsfarm, Seeis, Otjiwero, Gross-Witvley and Gobabis. New offices have also been opened at Jega and Oka, in Nigeria.

**Richmond (Surrey).** — The Town Council recently received a letter from the Postmaster-General stating that the telephone undertaking, if it were to be carried on at all, could not be saddled with the disproportionate expense of underground wires. In certain cases, however, lines would be placed underground on condition that the local authority agreed at its own expense to open the roads, dig and fill in the trenches, and reinstate the surface.

**Submarine Cable Repair.**—The c.s. *Grossherzog von Oldenburg* belonging to the Norddeutsche Seekabelwerke A.G., Nordenham a.d. Weser, Germany, has just established a record in deep water repairing work, having lifted and repaired an Atlantic cable at a depth of over 2,500 fathoms in the short period of four days and four hours after arrival on the cable ground, or three days from hooking the cable to slipping the final splice. The expedition was in charge of Mr. J. Giessen, Mr. H. E. Cann being the chief electrician.

**Telegraphic Interruptions and Repairs:—**

| Cables. | Interrupted. | Repaired. |
|---|---|---|
| Trinidad-Demerara (No. 1.) .. .. .. .. | Aug. 26, 1901 .. | .. |
| Dominica-Martinique .. .. .. .. .. | May 7, 1902 .. | .. |
| St. Lucia-Martinique .. .. .. .. .. | May 7, 1902 .. | .. |
| Leissa-Issa (Yemen) Camaran .. .. | Oct. 22, 1902 .. | .. |
| Cayenne-Pinheiro .. .. .. .. .. | Aug. 18, 1902 .. | .. |
| Port Arthur-Chifu (Closed) .. .. .. | Mar. 7, 1904 .. | .. |
| Tarifa-Tangier .. .. .. .. .. .. | Jan. 18, 1904 .. | .. |
| **Landlines.** | | |
| Puerto Barrios .. .. .. .. .. .. | Aug. 28, 1902 .. | .. |
| Bachkale-Deliman .. .. .. .. .. | Feb. 12, 1906 .. | .. |
| Trebizonde-Batoum .. .. .. .. .. | June 25, 1906 .. | .. |

**United States.**—The journal *Telephony* states that at the end of 1904 there were 300,000 telephones in the United States of America. The number of instruments in use at the present day is about 5,500,000, or one for every 16 inhabitants. The capital involved is put at about 3,000,000,000 fr. As a comparison, it is stated that the number of telephones in use in Europe on January 1st, 1906, was 1,675,000, or about 4·4 per 1,000 inhabitants.

**Venezuela.**—The British Consul at Caracas reports that a very serious obstacle to trade in Venezuela, which has affected almost every class of the community alike, has been the closing of the cable lately owned and worked by the Compagnie Française des Cables Télégraphiques. The system of the French company embraced the coast towns of Venezuela, and communicated direct with Hayti, &c., where it joined other lines of the same company. Merchants and others now no longer possess the advantage of cable communication abroad, and although a service of boats was started by the Government between Macuro, the terminus of the Venezuelan telegraphic system, and Trinidad, whence messages were forwarded by the West India and Panama Cable Co., this has now also been discontinued. Messages can consequently only be sent by mail to Curaçoa or Trinidad.

**Wireless Telegraphy.**—Under the heading of "New Wireless Installations," *l'Eclairage Electrique* states that in America a new station has been established at Springfield (Mass.) on the De Forest system. In Newfoundland, the Marconi Co. is erecting stations on the Labrador coast; 13 new stations are to be erected in Canada by the same company, besides the stations between Anticosti and Belle Isle, and at Cape May, Cape Race, Sable Island, Halifax, and on the coast of Nova Scotia. In Australia the Marconi Co. is establishing an experimental station between Queenscliff and Tasmania. In France all fortified places on the east and west coasts are to be connected with the Eiffel Tower in Paris. Communication has been established between Hammerfest and Spitzbergen.

The United States Consul at Tientsin reports that the Chinese Government has arranged to establish several stations throughout China for experiment with Marconi's system of wireless telegraphy, and to instruct Chinese operators in the working of the same. The apparatus has been installed on four Chinese men-of-war at Shanghai, and at the three northern Chinese cities of Tientsin, Peking and Paotangfu, the radius of action being about 230 kilometres, and the cost about 25,000 taels. An Italian officer has been appointed, not only as instructor, but also as engineer to superintend the installation, under whom a number of students have already been detailed to act as operators and to learn the art of management. It is also said that the viceroys throughout the Empire have been directed to consider the advisability of establishing other stations to work in conjunction with those above mentioned.

The British Consul at New Orleans reports that the United States Navy Department has officially accepted the De Forest Wireless Telegraph Stations at Panama, Guantanamo in Cuba, and Key West. The foregoing stations complete the chain of wireless stations built for the United States Government. The others are at Pensacola, in Florida, San Juan, Puerto Rico, and Colon. Three of the stations are of 1,000-mile radius, and two are of 450 miles.

Mr. Haldane recently stated that the War Department was experimenting with the Lodge-Muirhead and another system, but was not committed to the exclusive adoption of either. The Admiralty may not communicate from Admiralty shore stations in the United Kingdom by Marconi's system with any other system used by the War Department except during war time or case of emergency. But there would be no technical difficulty in such communication.—*Standard.*

According to the *Electrical World*, telephonic communication at Cheyenne (Wyoming) is quite impossible owing to the working of the wireless station at Denver, Colorado.

The text of the agreement between the Admiralty and the Marconi Wireless Telegraph Co., made on July 24th, 1903, was issued last week. According to the *Daily Telegraph*, it provides that the Admiralty shall have the full advantage of the existing Marconi patents, and all improvements in the same, for a period of eleven years, dating from April 1st, 1903; also, that they shall have the right to require the company, in each day of the said eleven years, for a time not exceeding twenty consecutive minutes, to forward and receive, at a rate not exceeding 5d. per word, to the exclusion of all other messages, to and from one of the company's long-distance stations. The exclusive right is to exist between six a.m. and eleven a.m. The company, on its part, undertakes to give priority to Admiralty messages, agreeably to the rules of the Berne Convention. The Admiralty Commissioners agree to pay to the Marconi Co. the sum of £20,000, "in consideration of the rights and privileges hereby granted and conferred," and, further, to pay a royalty of £1,600 on account of the then existing 32 installations; also, if the company shall duly perform its obligations under the indenture, the Admiralty agrees to pay, on or before April 30th every year, during the period of eleven years, the sum of £5,000. Another clause provides that the Commissioners shall be under no obligation to continue the business of maritime signalling or sea telegraphy at any of their stations, if the conduct of such business interferes with the efficiency of communication with his Majesty's ships. The company undertake to give naval operators instruction in wireless telegraphy, free of charge, at their stations, and to furnish instructors in the system at a charge of £1 per day and reasonable travelling expenses. The Admiralty retain the power to determine the agreement in case any of the patents are proved to be invalid.

## CONTRACTS OPEN and CLOSED.

### OPEN.

**Beckenham.**—July 23rd. Electric wiring of houses for the U.D.C. See "Official Notices" July 6th.

**Dublin.**—July 19th. Machinery oils for the Corporation electricity works. See "Official Notices" to-day.

**Dundee.**—July 13th. The T.C. invites tenders for six electric car bodies. Specifications from Mr. Peter Fisher, general manager, Corporation tramways. (Deposit 40s.)

**Hackney.**—July 26th. Arc lamps and arc lamp pillars, switch pillars, &c., for the Council. See "Official Notices" June 29th

**King's Norton and Northfield.**—July 16th. Tramways permanent way and electrical equipment for the U.D.C. See "Official Notices" July 6th.

**Leeds.**—July 16th. The Electricity Committee invites tenders for 150 tons of coal tar pitch.

**Shanghai.**—July 31st. Two 600-kw. steam turbo-dynamos or steam dynamos, condensing plant, motor-generator, switchboard, water-tube boilers, &c., for the Municipal Council. See "Official Notices" to-day.

**Spain.**—The municipal authorities of Gibraleon (province of Huelva) have just invited tenders for the concession for the electric lighting of the town during a period of 20 years.

**Sunderland.**—July 27th. Two 250-kw. synchronous motor-generators, and high and low tension switchgear, for the Corporation. See "Official Notices" July 6th.

**Wallasey.**—July 16th. A.C. transformers for the U.D.C. See "Official Notices" June 15th.

**Warrington.**—July 30th. Telescopic ladder tower, also overhead wire reel wagon, for the Warrington tramways department. See two "Official Notices" to-day.

**West Ham.**—July 13th. Cable and transformers for the electricity department. See "Official Notices" June 29th.

### CLOSED.

**Brussels.**—It is reported that the municipality of Brussels has placed contracts for the supply of armoured cables and for rubber-insulated service cables with the Felten and

Guilleaume-Lahmeyer Works Co., and the Deutsche Kabelwerke, of Berlin, respectively. The amount of the tender of the former company is 289,950 fr., and that of the latter 18,695 fr., whereas the tenders submitted by Belgian firms were much higher. A Belgian contemporary, in referring to the subject, asks why it is that when cables and accessories are needed the orders always go to Germany. Can it be, it is submitted, that the Belgian makers are unable to struggle advantageously with the competition emanating from the other side of the Rhine?

**Carlisle.**—The Electricity Committee has accepted the tender of the Electrical Power Storage Co., Ltd., for the supply of a traction battery of 250 P 21 cells, at £1,841 5s., with £8 8s. for each additional cell up to 10, and £110 per annum for maintenance; that of the Lancashire Dynamo and Motor Co., Ltd., of Manchester, for a reversible booster, motor-driven balancer, and shunt regulating switches and resistances, at £848 15s.; and that of Mr. Ewart Musgrave, for extension of the works, at £810.

**Colchester.**—The T.C. has accepted the tender of Mr. T. J. Ward for extending the car-shed and depôt, at £1,030.

**Durban.**—The Natal Government Railway has placed orders for various electrical machinery, cables, &c., with Messrs. Hubert Davies & Spain, and the British Insulated and Helsby Cables, Ltd. Some particulars are given in our "Lighting and Power Notes" to-day.

**Eccles.**—The T.C. has accepted the tender of Messrs. Mather & Platt, Ltd., for the supply of an engine and dynamo at £135.

**Hammersmith.**—The B.C. has received the following tenders for feeder cables for sub-stations:—

| | | |
|---|---|---|
| Western Electric Co. .. .. | (accepted) | £433 |
| Siemens Bros. & Co. .. .. .. .. | | 446 |
| Henley's Telegraph Works Co. .. .. | | 454 |
| Callender's Ltd. .. .. .. .. | | 454 |
| Glover & Co. .. .. .. .. .. | | 459 |
| British Insulated & Helsby Cables, Ltd. | | 460 |

**London.**—L.C.C.—The Highways Committee at Tuesday's meeting reminded the Council of the recent acceptance of the tender of Siemens Bros. & Co., amounting to £19,242 10s., for the supply of induction motor-generators required for the Limehouse, Shoreditch and Mildmay Park tramway sub-stations. Since that date a new company has been formed under the name of Siemens Bros. Dynamo Works, Ltd., to take over the dynamo branch of the business of Siemens Bros. & Co. As the contract with the latter company had not been completed the Committee proposed that it should be entered into with the new company.

**Salford.**—The Council has accepted the following tenders:—

Willans & Robinson, Ltd.—Willans-Brown Boveri turbo-generator, £6,185.

British Thomson-Houston Co., Ltd.—Tirrill regulator for automatically regulating the pressure of the direct current supply, £88, less 20 per cent.

S. Dixon & Son, Ltd.—Mechanical car accessories and overhead equipment.

Tandem Smelting Syndicate, Ltd.—Magnolia metal.

E. Boydell & Sons, Estler Bros., R. W. Blackwell & Co., John Hall, and Brecknell, Munro and Rogers.—Mechanical car accessories.

L. Andrew & Co.—Electrical car accessories, insulating materials, and wire.

Wm. McGeoch & Co., Ltd.—Electrical car accessories.

J. H. Holmes & Co.—Two sets of tramway feeder boosters, £480.

**Torquay.**—The T.C. has accepted the tender of Messrs. Browett, Lindley & Co., Ltd., for the supply of additional plant at the electricity works, at £1,079, and that of Messrs. Davis, Perrott, Ltd., of London, for de-oiling plant, at £315.

**West Ham.**—The Corporation has accepted the following tenders:—

Switchgear for motor-generators.—British Thomson-Houston Co., £154.

Last section (exhaust and water) of turbo-generator pipe-work.—Babcock and Wilcox, £102.

Motor switches.—Parmiter, Hope & Sugden.

Maintaining telephones and electric bells at the Plaistow Hospital for five years.—J. T. Halsey, £25 per annum.

**Wolverhampton.**—The T.C. has accepted the following tenders:—

Belliss & Morcom, Ltd.—High-speed engine, £1,850.

Thos. Parker, Ltd.—Generator, £695.

Mirrlees Watson Co., Ltd.—Condensing plant, £1,095.

Callender's Cable Co.—Cables and feeders.

## FORTHCOMING EVENTS.

Saturday, July 14th to 21st, inclusive.—Junior Institution of Engineers. Summer meeting. See page 25 last week.

Saturday, July 14th.—At 3 p.m. Association of Engineers-in-Charge. Visit to Wimbledon Corporation Electricity Works.

## NOTES.

**Our Guests from Over-Seas.**—The Dynamicables held their summer dinner on Tuesday evening, July 10th, at the Trocadero Restaurant, Col. H. C. L. Holden, R.A., F.R.S., occupying the chair. Invitations had been issued to the foreign guests who had taken part in the Institution of Electrical Engineers' circular tour, and about 30 accepted.

After the loyal toasts had been proposed and duly honoured, the members of the American delegation took the opportunity of presenting souvenirs as a token of their appreciation of the satisfactory manner in which all arrangements had been made for their comfort while on the tour. Mr. G. C. Lloyd, secretary of the Institution, and Mrs. Lloyd, were presented with a flower bowl; Mr. P. F. Rowell, assistant secretary, and Mr. R. Tree, chief clerk, with silver cigarette cases; and Mr. A. K. Langridge (in charge of the baggage arrangements) with a silver card case. The presentations were respectively made by Mr. S. S. Wheeler, Mr. C. O. Mailloux, Mr. R. W. Pope and Mr. J. W. Lieb.

The Chairman proposed the toast of the evening, viz., "Our Guests from over-Seas." Speeches in reply were made by Mr. Guido Semenza, representing the Associazione Elettrotecnica Italiana; Mr. S. S. Wheeler, the American Institute of Electrical Engineers; Dr. E. Naglo, the Verband Deutscher Elektrotechniker; and Vicomte de France, the Société Internationale des Electriciens. All spoke most enthusiastically and cordially of the reception accorded them, not only while on the circular tour, but by their "Dynamic" brethren that evening.

Col. R. E. Crompton, C.B., proposed the health of Mr. R. Kaye Gray, and made allusion to the unavoidable absence of many prominent Dynamicables.

Mr. C. O. Mailloux proposed, in happy and cordial terms, the toast of "The Dynamicables," to which Mr. J. E. Kingsbury as happily replied.

General E. R. Festing, C.B., proposed the toast of "The Chairman," to which Col. Holden responded, and this brought to a conclusion one of the most successful evenings spent by the society since its resuscitation, and, perhaps, since its foundation. Great praise was due to the energetic hon. secretary, Mr. Sydney Sharp, and the secretary, Mr. R. Tree, for the admirable arrangements made for the comfort of the visitors.

A programme of music, carried out by Miss Edith Spain, Mr. Frederick Henry and Mr. Gatehouse (member of Council), added to the enjoyment of the evening.

**A Book for Tramcar Drivers.**—While so much attention is just now being directed to the important question of electric tramcar control, with special reference to braking equipments and their efficient manipulation, we would draw the attention of tramway managers and engineers to the sections of special interest that are published on these points in Mr. W. A. Agnew's "Electric Tramcar Handbook" (ELECTRICAL REVIEW Publishing Department, 2s. 6d. net.) The fitness of a driver for efficiently handling a car, and his preparedness for emergencies are likely to be considerably improved if by means of non-technical language, and in terms freed from abstruse phraseology, he is enabled to secure an intelligent grasp of the principles and details of the equipment under his charge—especially the braking and other controlling appliances. It is these things that Mr. Agnew has aimed at in his book, and we should add that the advice it contains is specially based upon British tramway practice. Tramway managers should consider whether it would not be worth their while to give or lend a copy of this work to their employés to consider as they smoke, and, perhaps, in addition, sections of the work might be made use of as a basis for occasional lectures to the tramway employés called together in batches expressly for the purpose as opportunity arose.

**The Emile Dollfus Prize.**—The Société Industrielle de Mulhouse has just awarded this prize (2,500 fr. and a medal) conjointly to the Hon. C. A. Parsons, inventor of the steam turbine, and to Messrs. Brown, Boveri & Co. for their distinguished efforts in the construction and perfecting of the turbine and furtherance of its use on the Continent. The prize is awarded for discoveries, inventions or applications made during the last ten years.

**Cooper Patent Anchor Rail Joint Co., Ltd., v. the British Electric Equipment Co., Ltd.**—This case came before the Appeal Court on Wednesday by way of an appeal against the refusal of Mr. Justice Joyce to grant a certificate that the defendants' particulars of objection were reasonable and proper, the plaintiffs, the patentees, having discontinued the action after delivery of the particulars of objection.—Their Lordships dismissed the appeal with costs.

**British Trade in June.**—During the month of June the trade of the country was in a very prosperous condition, according to the Board of Trade returns. The imports showed an increase of £4,335,302, and the exports an increase of £4,653,790 over the returns for the corresponding period of last year. For the first six months of the year there was an increase of nearly 27½ millions sterling, or over 10 per cent. in imports. The total exports showed an increase of nearly 25 millions, and the re-exports an increase of £4,364,589. It is regrettable to note, however, that among the few items in our exports that show decreases for the month of June is that of electrical apparatus with a drop of £143,558. Iron and steel manufactures and machinery show substantial advances.

**Lighthouse Illumination.** — A paragraph having appeared in the *Times* stating that the Lizard Lighthouse was employing the Kitson oil system instead of electricity, the Secretary of Trinity House has written saying that the statement is incorrect, "as electricity has been in constant use at that station since its first installation there, upwards of 30 years ago, and there is no intention of changing it." An incandescent oil burner is provided as a stand-by in case of accident.

**Electric Shock Fatality.**—On 9th inst. at Wednesbury an inquest was held concerning the death of Frank Davis, an electrician, at the Patent Shaft Works, who while localising a breakdown, caught hold of a live wire. He received a shock at 1,600 volts. The jury returned a verdict of "Accidental death."

At the inquest, Mr. John Lewis Andrews, who is in charge of the whole of the electrical appliances at the works, stated that last Friday afternoon he went in company with deceased and two other men to the sub-station in the wheel department for the purpose of localising a breakdown. Whilst engaged in examining the different wires, he noticed a flash, and upon turning round, saw deceased had got hold of a live wire. Witness snatched him off immediately, but Davis exclaimed, "Oh, I have got it," and collapsed. They started to use artificial means of respiration, but this was of no avail. Witness considered that Davis died immediately; whilst another workman said it was "all done like a flash." It was further stated in evidence that deceased was a thoroughly competent electrician. This is the second instance in which a workman has been killed by electric shock at these works.

**The Post Office Telegraphists.**—The Post Office Select Committee in the course of its inquiry has, as is the case in all such Committees, to hear remarkable statements by the witnesses examined. The following (if correctly reported, which may be doubtful) is worthy of record:—

"You say that improvements in the instruments have been made, and that they are less liable to get out of order—that the ordinary telegraphist is called upon to exercise no greater skill in adjusting the instrument than is required by a woman who works a sewing machine. Do you know this yourself personally?—Yes. It is a very simple matter. There is a screw in the relay; if the current is too strong he turns the screw one way; if the current is too weak he turns it the other. *It is a matter of the earth.*

"That scarcely squares, does it, with the statement of Sir William Preece recently as to the development of telegraphy, and Prof. Thomson?—I think the instrument has been simplified and improved of late years. That corresponds with the actual facts, and even that adjustment is a very rare thing; *it happens about once in a fortnight.*"

Apart, however, from the absurdity of the explanations credited to the witness—one of the Postal Surveyors—there is a strong element of truth in what was said; the comparison between the skill required to adjust a sewing machine and a telegraph apparatus is, in our opinion, a perfectly fair one, and we unhesitatingly say that it requires at least as much skill to adjust a sewing machine as it does to adjust a double-current sounder set. We may mention, indeed, that on putting the question to a lady telegraphist at a country office where such a set was in use, the answer was prompt and given without hesitation, that the telegraph apparatus was the easier to adjust. We are very much of the opinion that telegraphists hold (or pretend to hold) a far higher estimate of their skill than is justifiable; but we do not by this suggest that their rate of pay is, therefore, more than adequate, or even adequate, for the duties which they have to perform.

**International Electro-Technical Commission.**—We are asked to correct an error which appeared in the list of delegates as received by us, and as published on p. 16 of our last issue. The names of Canadian representatives inaccurately appeared under the Belgian section. Belgium and Canada sent delegates as follows:—

Belgium (Société Belge d'Electriciens).—Mons. Leon Gérard.

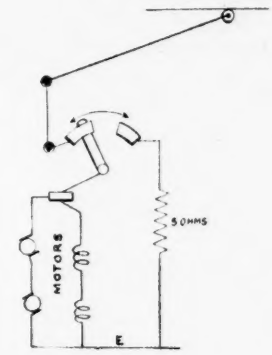
Canada (Local Standards Committee).—Dr. R. B. Owens, Mr. L. A. Herdt.

**The Canadian Electrical Association.**—The annual meeting, which was largely attended, was held this year at Niagara Falls on the American side. In his official address to the delegates, Mr. A. R. Wright, M.P., President of the Association, gave prominence to the Government's proposal to electrify the Temiskaming Railway in Northern Ontario. He characterised the scheme as a forward movement of the first magnitude. A number of interesting papers were read, and the delegates were enabled to make an inspection of the power plants on both sides of the Niagara River. The proceedings, which lasted two days, June 20th and 21st, terminated with the election of the following officers for the ensuing year:—

President, R. G. Black, superintendent of the Toronto Electric Light Co.; Vice-Presidents, R. S. Kelsch, of Montreal, and W. N. Ryerson, of the Ontario Power Co., Niagara Falls; Secretary and Treasurer, T. S. Young, of Toronto. Quebec and Montreal both sent invitations for next year's meeting, but the matter of selecting the place was left to the Executive Committee.

**Freaks of Gas.**—Trouble continues at Pontypool through gas exploding in the street electric light boxes, and the papers are calling these occurrences "Freaks of Electricity"! As the Appeal Court held in the Ogden and Smith case, reported in our last issue, so we hold in this case, that the negligence of the gas supply authority in *allowing the gas to be there* is "the efficient cause."

**Regenerative Tramcar Control.**—In our account of the demonstration of the Raworth regenerative system on the Crystal Palace tramways, we referred to the braking effect of the regenerative system as absolutely safe so long as the trolley was not dewired. We are now informed that an automatic device has recently been applied to the regenerative cars which meets the case excepted. When a car is running downhill and returning current to the line by regenerative action, should the trolley wheel leave the wire, the motors being shunt wound, continue to excite




their fields, and the voltage rises until it actuates an automatic throw-over canopy switch; this places a resistance of 5 ohms across the motor terminals, and the resulting current produces a retarding torque amply sufficient to brake the car. The action is entirely automatic, and takes place without any movement of the controller. Thus the car is always under control, whether the trolley wheel is on the wire or off. The connections are shown in the accompanying diagram.

This device is, of course, quite independent of the rheostatic brake, which, as we mentioned, is fitted on the regenerative cars, and which is independent of the power circuit.

**Belgian Engineers.**—About 400 members of the "Société Belge des Ingenieurs" and their wives visited Antwerp on Saturday, July 7th. They were shown over the central electric power station of the Antwerp Tramways and a sub-station by the managing director, Mr. Charles Charlier, who is also managing director of the Mutuelle Tramway Co., of Brussels, the parent company of 21 Continental tramway companies registered in Brussels. After lunch in the Zoological Gardens of Antwerp, where there is one of the finest collections of animals in Europe, many engineers visited the streets where the conduits of the H. B. Camp Co. are being laid. These are supplied by Mr. Douglas Wells, M.I.E.E., of Brussels; already nearly 4,000,000 ft. are laid in Belgium, in the towns of Brussels and Liége for the Belgian Telegraph and Telephone Departments, and several electric companies have decided to use Camp conduits in that country in place of a solid system. Special wagonettes took the party to the works of the Bell Telephone Manufacturing Co., which is a branch of the Western Electric Co., of London, where they saw the latest machinery for making telephones, switchboards, &c.

**Industrial Redistribution.**—We have received from the North-Eastern Railway Commercial Agents' Office at York an illustrated pamphlet which is being issued by the Tees Conservancy Commissioners. A good deal of useful information is contained in it concerning the industrial sites and possibilities of the River Tees. It will be remembered that in a recent article on industrial redistribution, we set forth in some detail the claims of the North-Eastern Railway district, and urged their consideration by manufacturers who were desirous of setting up new factories where rates, rents and wages were low, and where transport and power facilities were ample. Those who are interested in the matter should write for a copy of this pamphlet, which deals with Stockton-on-Tees and Middlesbrough.

**Overhead v. Underground Telephone Wires.**—On Friday last a decision was reached in the dispute between the Post Office and St. Pancras Borough Council as to whether the former should be allowed to erect three iron poles in Camden Town, to carry overhead wires for fire alarms and telephones. The B.C. demanded that the wires should be put underground, and after eight months' negotiation the matter was referred to the arbitration of Mr. Paul Taylor.

Mr. M. P. Roberts (assistant engineer-in-chief to the Post Office) stated that the overhead installation would cost £26 6s. 11d., whilst underground wires would cost £55 14s. 4d., and he scouted the idea of danger from overhead wires, not a single person having been seriously injured by them in 25 years. He said that in London and the surrounding districts there were 8,345 miles of overhead wires, and about 8,000 miles of underground trench work.

The arbitrator decided against the B.C., stating that the evidence showed that the overhead system was less inconvenient and dangerous to the public than the underground system. The B.C. will pay costs.

**India.**—A Calcutta newspaper says: "It is proposed to authorise local government to appoint electrical inspectors under the Electricity Act of 1903."

**Appointments Vacant.**—Assistant lecturer and demonstrator in electrical engineering for the Leeds University (£175); shift engineer for Leicester tramways power station (45s.); junior assistant engineers for the Newcastle-upon-Tyne Electric Supply Co.; switchboard attendants, station supervisors, jointers, &c., for Portsmouth and Malta Dockyard generating stations; assistant lecturer and demonstrator in electrical engineering at Birmingham University (£150).

**Wills.**—It is stated that the late Mr. William Stratford Andrews left estate of the gross value of £76,223, including £73,478 in net personalty.

According to the *Financial News* Mr. John Goddard, deputy-chairman of the North Metropolitan Tramways Co., and a director of the Metropolitan Electric Tramways, Ltd., who died on March 25th, left estate of the gross value of £982,626.

**Electric Ambulances.**—The City Corporation Police Committee has decided to proceed with a scheme for electrically-driven ambulances for the city, on the ground that they are more economical than horse traction and better suited for narrow thoroughfares.

**Industrial Freedom League.**—The annual meeting of this League was to be held at the Westminster Palace Hotel yesterday, 12th inst., with Sir Felix Schuster in the chair.

**Electrical Manufacturing in Russia.**—It appears that the United Cable Works, of St. Petersburg, to which reference was made in our editorial columns on June 15th as having taken over the cable departments of the Russian subsidiaries of three German companies, commenced operations on January 1st, 1906, although the definite constitution of the new company is awaiting Government sanction, which is expected shortly. This information is contained in the report for 1905 of the Russian Siemens and Halske Co., which mentions that the separation of the cable department from the other branches has necessitated an alteration in the agreement with the Russian Schuckert Co. The report also states that the political and economic movements during 1905 had an unfavourable influence on business, and the serious affairs of the last three months of the year not only caused a noteworthy decline in the sales, but also rendered working more difficult and costly. The position of prices did not improve, and the lack of orders largely conduced to underselling by the trade, the final result of the year's operations being a balance of £2,951, which has been carried forward to the accounts for 1906. As the new Russian tariff is of a more highly protectionist character and likely to cause a greater demand for manufactures produced in the country, the company began in 1905 an extension and reconstruction of the dynamo works and mechanical workshops, which also aim at finding compensation for the transfer of the cable factory. The new tariff has, however, so far—that is, down to the beginning of June—not had a favourable effect upon business, notwithstanding that the duties on dynamos and motors have been increased by over 400 per cent. In fact, it is mentioned that these manufactures are still obtainable at approximately the same prices as those which prevailed a year ago.

**Halifax.**—At the inquest on the two victims of the recent tramway accident, which concluded on Wednesday, the jury returned a verdict of "Accidental death."

## OUR PERSONAL COLUMN.

***The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the* ELECTRICAL REVIEW *posted as to their movements.***

**Central Station Engineers.**—The Burnley T.C. has increased the salary of Mr. J. E. STARKIE, electrical engineer, from £250 to £300 per annum.

The Southend-on-Sea T.C. has decided, by 10 votes to 6, to invite Mr. R. BIRKETT, electrical engineer and tramway manager, to reconsider his resignation.

The Colchester T.C. has increased the salary of the electrical engineer from £305 to £315 per annum, as from April 1st, 1906, with annual increments of £10 to £355, and the full premiums of all articled pupils.

The Crewe T.C. has appointed Mr. C. B. HOBSON, of Swansea, as junior shift engineer at the electricity works.

It was reported at the meeting of the Torquay T.C. on July 3rd, that Mr. STOREY, electrical engineer, was seriously ill, and would undergo an operation the following day. The Council passed a vote of sympathy with Mr. and Mrs. Storey.

On 9th inst. the engine-room staff at Regent's Park station of the St. Pancras B.C. presented Mr. A. N. DIXEY (late charge engineer) with a silver cigarette case. Mr. Dixey is leaving to take up a position in India.

**Tramway Officials.**—The manager and staff of the Salford Corporation tramways have presented a silver fern bowl to Mr. WM. BILLINGTON on his marriage.

The Southend-on-Sea T.C. has appointed Mr. BERNARD ANDREWS, traffic superintendent of the Eastbourne Corporation motor-'buses, as tramway traffic superintendent.

**General.**—Mr. R. W. SMITH, chief electrician to De Beers Consolidated Mines in South Africa, was recently married at Kimberley to Miss Lottie Stark. The ceremony took place at the residence of the bride's mother, and Mr. and Mrs. Smith subsequently left for the Victoria Falls in Rhodesia.

Mr. FRANK COLLINS, who has for the past 12 months held the position of representative for the Electric and Ordnance Accessories Co., Ltd. (Vickers, Sons & Maxim, Ltd.), in Birmingham and Midlands, has resigned to take up an appointment as manager for Mr. J. M. Kaiser, manufacturing electrical and mechanical engineer, Dale End, Birmingham.

On July 5th Mr. LANCELOT W. WILD, chief electrician of Westminster Electrical Testing Laboratory, was married to Violet C. Forty, daughter of W. M. Forty, mineral water manufacturer, of Newton Abbot, at Holy Trinity Church, Paddington.

Mr. E. W. WATSON, chief clerk of the Doncaster Corporation electricity works, was recently presented by the tramway and electricity staff with an oak clock, on the occasion of his leaving the town.

## NEW COMPANIES REGISTERED.

**Albert Dickinson, Ltd.** (89,096).—This company was registered on June 12th, with a capital of £2,000 in £1 shares, to carry on the business of electrical engineers and contractors, electricians, suppliers of electricity, carriers of passengers and goods, manufacturers of electrical apparatus and machinery, &c. The first subscribers (each with one share) are:—C. D. Hood, 7, Barden Grove, Armley, manager; R. M. Kingston, 58, Middleton Avenue, Leeds, traveller; C. Eaves, 3, Highthorne View, Armley, traveller; H. Lawton, Cross Lane, Wortley, draper; F. A. Holdsworth, 15, Park Row, Leeds, chartered accountant; W. Bateson, 64, Wellington Street, Leeds, solicitor; and Mrs. C. Dickinson, 3, Barden Grove, Whingate, Armley. No initial public issue. The number of directors is not to be less than three or more than five; the subscribers are to appoint the first; qualification, £10.

**Beaumont and Still Train-Lighting Co., Ltd.** (89,190).—This company was registered on June 20th, with a capital of £18,000 in £1 shares, to acquire from M. W. W. Mackie, E. J. Glyn, A. R. M. Lockwood, F. J. Beaumont, and W. M. Still, the benefit of certain existing inventions relating to improvements in electric dynamos, and the lighting of railway carriages and other vehicles by dynamos on such a system that the train or coach drives a dynamo at a varying speed, but that such dynamo is self-regulating, to adopt an agreement with the said vendors, and to carry on the business of electricians, electrical and general engineers, suppliers of electricity, manufacturers of dynamos and other electrical apparatus, &c. The first subscribers (each with one share) are:—F. J. Beaumont, 21, Albany Road, Stroud Green, N., engineer; W. M. Still, 24, Charles Street, Hatton Garden, E.C., metal worker; C. T. Burke, Penn Road, Beaconsfield, Bucks, secretary; E. J. Glyn, Newland Lodge, Ingatestone, Essex, electrical engineer; M. W. W. Mackie, 45, Warwick Road, Ealing, electrical engineer; F. G. Still, 24, Charles Street, Hatton Garden, E.C., metal broker; and E. H. Still, 24, Charles Street, Hatton Garden, E.C., metal worker. No initial public issue. The number of directors is not to be less than two, or more than five; the first are E. J. Glyn, W. G. Richards, M. W. W. Mackie, F. J. Beaumont and W. M. Still; qualification, £250; remuneration (except managing director) as fixed by company.

**Brown, Boveri & Co., Ltd.** (89,167).—This company was registered on June 18th, with a capital of £50,000 in £5 shares (1,500 "A" and 8,500 "B"), to carry on the business of electrical and general engineers, suppliers of electricity for light, heat and power, ironfounders, copper smelters and workers, &c., and to adopt agreements (1) with A. G. Brown, Boveri et Cie., (2) with A. C. Eborall, and (3) with Witting, Eborall & Co., Ltd. The first subscribers (each with one share) are:—C. E. L. Brown, Baden, Switzerland, manufacturer; W. Boveri, Baden, Switzerland, manufacturer; C. Baumann, Baden, Switzerland, manufacturer; S. W. Brown, Baden, Switzerland, manufacturer; E. Brown, Baden, Switzerland, engineer; A. C. Eborall, 115, Tulse Hill, S.W., electrical engineer; C. E. Holland, 4, Redington Road, N.W., electrical engineer. No initial public issue. The number of directors is not to be less than two or more than seven; the first are C. E. L. Brown, W. Boveri, C. Baumann and A. C. Eborall; qualification, £250; remuneration as fixed by the company.

**Swanage Electricity Supply Co., Ltd.** (89,186).—This company was registered on June 19th, with a capital of £10,000 in £10 shares, to carry on the business of electrical engineers, electricians, contractors, suppliers of electricity, manufacturers of electrical apparatus, &c. The first subscribers (each with one share) are:—A. H. Sanderson, Darfield, Bournemouth, gentleman; H. B. Renwick, Burnham, Roehampton, S.W., secretary; F. C. McQuown, Moorgate Court, E.C., electrician; G. Tweedie, Moorgate Court, E.C., accountant; J. G. Shortis, 103, Cricklewood Broadway, N.W., registrar; J. Hazard, Melrose, Muswell Avenue, Muswell Hill, N., accountant; and J. J. Lightfoot, 42, St. James's Place, Plumstead, S.E., electrician. No initial public issue. The number of directors is not to be less than three or more than seven; the subscribers are to appoint the first; qualification, £100; remuneration as fixed by the company. Registered office, Moorgate Court, E.C.

**Coatbridge and Airdrie Electric Supply Co., Ltd.** (89,178).—This company was registered on June 19th, with a capital of £30,000 in £10 shares, to acquire the business carried on at Moorgate Court, E.C., at Henderson Street, Coatbridge, N.B., and at Craig Street, Airdrie, N.B., as the "Scottish House-to-House Electricity Co., Ltd.," to adopt an agreement with the said company, and to carry on the business of electrical engineers, electricians, producers and suppliers of electricity for light, heat, sound and power, manufacturers of electrical apparatus, &c. The first subscribers (each with one share) are:—A. Ayres, M.I.C.E., Ashleigh Road, Wood Green, N.; F. E. Savory, Bourne, Farnham, Surrey, director; H. B. Renwick, Burnham, Roehampton, secretary; F. C. McQuown, Moorgate Court, E.C., electrician; G. Tweedie, Moorgate Court, E.C., accountant; J. G. Shortis, 103, Cricklewood Broadway, N.W., registrar; and J. J. Lightfoot, 42, St. James' Place, Plumstead, S.E., electrician. No initial public issue. The number of directors is not to be less than two or more than seven; the first are A. Ayres, F. E. Savory and P. Murray; qualification, £10; remuneration as fixed by the company. Registered office, Moorgate Court, E.C.

**La Plata Syndicate, Ltd.** (89,182).—This company was registered on June 19th, with a capital of £30,000 in £1 shares, to adopt an agreement with B. Newgass to construct or acquire any tramways and light railways in the Argentine Republic, and to carry on the business of tramway, railway, omnibus and van proprietors, carriers of passengers and goods, suppliers of electricity, &c. The first subscribers (each with one share) are:—W. J. Yeoman, 23, Muschamp Road, East Dulwich, S.E., clerk; G. E. Sanders, Bloomfield Lodge, Larkfield Road, Richmond, Surrey, clerk; A. J. Swan, 18, Ashbourne Grove, Chiswick Lane, Chiswick, clerk; S. H. Penwarden, 7, Comely Bank Road, Walthamstow, clerk; J. W. Pollard, 13, Hartswood Road, Shepherd's Bush, W., clerk; F. W. Cowham, 118, Minard Road, Hither Green, S.E., clerk; and P. M. Cullen, 30, Paxton Road, St. Albans, Herts, secretary. No initial public issue. The number of directors is not to be less than three or more than seven; the subscribers are to appoint the first; qualification, £500; remuneration as fixed by the company.

**D. Santoni & Co. (1906), Ltd.** (89,277).—This company was registered on June 27th, with a capital of £10,000 in £1 shares, to take over the business of electrical and general engineers, contractors, manufacturers of electrical and mechanical appliances for lighting, power and traction, importers and exporters of economic, domestic, scientific, curative and pastime and electrical appliances, dealers in electrical goods and accessories carried on by D. Santoni & Co., Ltd., of 15 and 17, Beauchamp Street, Brooke Street, E.C., and to adopt an agreement with the said company. The first subscribers (each with one share) are:—Leon Duchesne, 21, Carson Road, West Dulwich, S.E., representative; J. Mortimer, South Court, Kingston-on-Thames, accountant; T. P. Stave, 23, Bedford Street, Strand, W.C., engineer; K. Fredler, 3, St. Stephen's Square, Bayswater, W., secretary; D. Santoni, 11, Coburg Place, Kensington, W., managing director; Charlotte Morgan, 2a, Berners Street, Oxford Street, W., clerk; and A. Santoni, 1, Colville Square, W., gentleman. No initial public issue; the number of directors is not to be less than two or more than five; the first are not named; qualification, £1; remuneration, two guineas each per monthly meeting attended; managing director to receive £350 additional remuneration per annum. Registered office, 15 and 17, Beauchamp Street, Brooke Street, E.C.

**B.P.B. Syndicate, Ltd.** (89,242).—This company was registered on June 25th, with a capital of £6,000 in £1 shares, to construct, equip and work railways, tramways, light railways and undertakings for the generation, utilisation, supply or distribution of electrical or other power, &c. The first subscribers (each with one share) are:—A. H. Coneybeare, 163, Tranmere Road, Earlsfield, S.W., clerk; F. Hopton, 16, Delamere Terrace, Paddington, W., clerk; J. M. Tolley, Coniston, Blakeney Road, Beckenham, clerk; F. W. Davis, 35, Matham Grove, East Dulwich, S.E., clerk; H. James, Homeleigh, East Crescent, Enfield, clerk; J. W. H. Coneybeare, 32, Quinton Street, Earlsfield, clerk; and E. J. Alldis, 109, Thorpe Road, Forest Gate, E., clerk. No initial public issue. The number of directors is not less than two or more than eight; the subscribers are to appoint the first. Remuneration as fixed by the company.

**Home Counties Electricity Supply Co., Ltd.** (89,279).—This company was registered on June 27th, with a capital of £1,000 in £1 shares, to carry on the business of suppliers of electricity, electricians, electrical and mechanical engineers, manufacturers of and dealers in electrical apparatus, &c. The first subscribers (each with one share) are:—G. W. P. Johnston, A.M.I.M.E., 110, Cannon Street, E.C., engineer; J. Hewett, M.I.C.E., 5, Budge Row, E.C., consulting engineer; L. Alder, 64, Sarre Road, West Hampstead, N.W., clerk; H. I. Elliott, 3, Bramah Road, Brixton, S.W., clerk; J. M. Johnston, 79, Mark Lane, E.C., shipowner and merchant; T. M. Johnston, 79, Mark Lane, E.C., stone merchant; and W. S. Johnston, 79, Mark Lane, E.C., engineer. No initial public issue. The number of directors is not to be less than two or more than five; the subscribers are to appoint the first; qualification, £100; remuneration as fixed by the company. Registered office, 137, Cannon Street, E.C.

**Irish Electrical Agency, Ltd.** (89,281).—This company was registered on June 27th, with a capital of £50 in 1s. shares, to carry on the business of an electric light and power company, electrical engineers, electricians, contractors, manufacturers of and dealers in electrical and other appliances, &c. The first subscribers (each with one share) are:—G. Morgan, 56, Shaftesbury Road, Crouch Hill, N., clerk; F. J. Berry, 34, Frampton Road, N.E., clerk; E. Roomes, Sanctuary House, Tothill Street, Westminster, clerk; C. Whitfield, Angelzark, Kettering, engineer; H. Collett, Sanctuary House, S.W., engineer; and W. T. Fenny, 130, Lyndhurst Road, Bowes Park, N., clerk. No initial public issue. The number of directors is not to be less than two or more than three; the first are not named. Registered office, Sanctuary House, Tothill Street, Westminster.

**British Electrical Tool Co., Ltd.** (89,294).—This company was registered on June 28th, with a capital of £5,000 in £1 shares, to adopt an agreement with T. Crawshaw and to carry on the business of manufacturers of and dealers in electrical tools, &c. The first subscribers (each with one share) are:—T. Crawshaw, 10, Dorset Terrace, Leeds, engineer; H. Bennett, 5, Beechwood Road, Burley, Leeds, engineer; J. Yeadon, Radcliffe-on-Trent, Nottingham, traveller; A. Wilkinson, Roundhay, Leeds, draper; P. Higgins, Rosemead, Farsley, Bradford, plumber; S. G. Atkinson, 19, Stanmore Avenue, Leeds, clerk; and G. Darbyshire, 20, Belle Vue Road, Leeds, clerk. No initial public issue. The number of directors is not to be less than three or more than five; the first are T. Crawshaw (chairman), H. Bennett, J. Yeadon, and A. Wilkinson: qualification, 200 shares; remuneration (except managing director), £100 per annum, divisible. Registered office, Cardigan Iron Works, Lennox Road, Leeds.

## OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

**London United Tramways, Ltd.** (71,844).—This company's annual return was filed on May 10th, when 125,000 preference and 100,000 ordinary shares had been taken up out of a nominal capital of £2,500,000 in 125,000 preference and 125,000 ordinary shares of £10 each. £10 per share has been called up on 89,000 preference, £4 per share on 39,993 ordinary, and £10 per share on 7 ordinary, resulting in the receipt of £1,050,042. £960,000 is considered as paid on 96,000 shares. Mortgages and charges, £1,331,000.

**County of Northampton Electric Power and Traction Co., Ltd.** (65,747).—This company's annual return, made up to May 14th, has been filed. The entire capital of £25,000 in 2,500 shares of £10 each has been taken up, and £9 5s. per share has been called up, resulting in the receipt of £23,125. Mortgages and charges: Nil.

**Kidderminster and District Electric Lighting and Traction Co., Ltd.** (59,972).—The company's annual return was filed on May 3rd, when 3,000 preference and 4,700 ordinary shares had been taken up out of a nominal capital of £100,000 in 5,000 preference and 5,000 ordinary shares of £10 each. £10 per share has been called up, and £77,000 has been received. Mortgages and charges: £27,500.

**General Electric Tramways Co., Ltd.** (43,428).—This company's annual return was filed on April 26th, when 18,500 shares had been taken up out of a nominal capital of £50,000 in £1 shares. £1 per share has been called up and £18,500 has been received. Mortgages and charges: £15,000.

**Cape Electric Tramways, Ltd.** (54,636).—Particulars of £230,000 5 per cent. debentures, created by resolution of January 10th, 1906, have been filed pursuant to Sec. 14 (4) of the Companies' Act, 1900. Property charged: The debentures constitute a second charge on shares in the Metropolitan Tramways Co., Ltd.; the Southern Suburbs of Cape Town Tramways Co., Ltd.; the City Tramways Co., Ltd.; and the Port Elizabeth Tramway Co., Ltd., and a floating charge on the company's undertaking and other assets. Trustees under deed of February 7th, 1906 (not registered): F. Eckstein, 1, London Wall Buildings, E.C., and H. Birchenough, 79, Eccleston Square, Pimlico.

**Lymington Electric Light Co., Ltd.** (57,985).—This company's annual return was filed on May 15th, when 1,710 ordinary and 1,284 preference shares had been taken up out of a nominal capital of £30,000 in 4,600 ordinary and 1,400 preference shares of £5 each. £5 per share has been called up on 1,710 ordinary and 700 preference and £4 per share on 584 preference, resulting in the receipt of £14,636. £145 remain in arrears. Mortgages and charges: £10,000.

**Kramos, Ltd.** (electrical engineers, Bath) (82,859).—Issue on May 25th of £200 6 per cent. debentures, part of series created February 22nd, 1905, to secure £4,000, charged on the company's undertaking and property, present and future, including uncalled capital. Holder: W. H. Gowing, 22, Priory Road, Barking. No trustees. Previously issued of same series: £1,900.

**Bromley (Kent) Electric Light and Power Co., Ltd.** (54,127).—This company's annual return was filed on April 24th, when 14,000 shares had been taken up out of a nominal capital of £100,000 in 20,000 shares of £5 each. £70,000 has been received. Mortgages and charges: £70,000.

**Brompton and Kensington Electricity Supply Co., Ltd.** (25,913).—This company's annual return was filed on June 15th, when 29,828 ordinary and 10,172 preference shares had been taken up out of a nominal capital of £300,000 in 40,000 ordinary and 20,000 preference shares of £5 each. £5 per share has been called up on 28,828 ordinary and 10,172 preference, resulting in the receipt of £195,000. £5,000 is considered as paid on 1,000 ordinary. Mortgages and charges: Nil.

**Auto-Claw Co., Ltd.** (London) (85,218).—Memoranda of satisfaction in full of two charges, dated respectively November 20th and 24th, 1905, securing £750 each, have been filed. A debenture dated June 6th, 1906, to secure £1,000, charged on the company's undertaking and property, present and future, including uncalled capital, has also been registered. Holders: C. W. Langford and C. H. Cartwright, both of 1, Bank Buildings, Balham, S.W.

**Indo-European Telegraph Co., Ltd.** (3,953).—This company's annual return was filed on May 16th, when 17,000 shares had been taken up out of a nominal capital of £450,000 in 18,000 shares of £25 each; £25 per share has been called up, resulting in the receipt of £425,000. Mortgages and charges: Nil.

**Folkestone Electricity Supply Co., Ltd.** (51,825).—This company's annual return, made up to April 19th, has been filed. The entire capital of £100,000 in £5 shares has been taken up and paid for in full. Mortgages and charges: £90,000.

**Northampton Electric Light and Power Co., Ltd.** (28,640).—Issue on May 18th of £500 and on May 30th of £600 4 per cent. debentures, part of series created June 3rd, 1896, to secure not more than two-thirds of the paid up capital for the time being, charged on the company's undertaking and property, present and future, including uncalled capital. No trustees. Previously issued of same series: £34,200.

**Northampton Electric Light and Power Co., Ltd.** (28,640).—Issue on June 20th of £300 4 per cent. debentures, part of series created June 3rd, 1896, to secure not more than two-thirds of the subscribed and paid-up share capital for the time being, charged on the company's undertaking and property, present and future, including uncalled capital. No trustees. Previously issued of same series: £35,300.

**Scottish House-to-House Electricity Co., Ltd.** (29,232).—A charge dated June 18th, 1906, to secure £3,250, charged on the company's undertaking and property, present and future, including uncalled capital and the Coatbridge and Airdrie undertakings, has been registered. Holders; County of London Electric Supply Co., Ltd., Moorgate Court, E.C.

**Marconi International Marine Communication Co., Ltd.** (London) (65,759).—Issue on June 18th of £8,000 7 per cent. debentures, part of series created on November 20th, 1905, to secure £25,000 charged on the company's undertaking and property, present and future, including uncalled capital. No trustees. Previously issued of same series: £8,000.

**New Electric Rifle and Target Co., Ltd.** (London) (87,477).—A 10 per cent. debenture dated June 13th, 1906, to secure £2,000 charged on the company's lands, hereditaments and property, present and future, including uncalled capital, have been registered. Holder: P. L. Jacques, Silsden, near Keighley, Yorks. A memorandum of satisfaction in full of a debenture dated May 4th, 1906, securing £700, has been filed.

**Manlove, Alliott & Co., Ltd.** (48,988).—This company's annual return, made up to March 28th, was filed on May 31st. £5,572 ordinary and 797 preference shares have been taken out of a nominal capital of £150,000 in 3,000 preference and 12,000 ordinary shares of £10 each. £10 per share has been called up on 463 ordinary and 797 preference, resulting in the receipt of £12,600. £51,090 is considered as paid on 5,109 ordinary. Mortgages and charges: £50,000.

**Hartlepool Electric Tramways Co., Ltd.** (49,734).—This company's annual return was filed on April 28th, when the entire capital of £100,000 in 10,000 shares of £10 each had been taken up and paid for in full. Mortgages and charges: £50,000.

**North Metropolitan Electrical Power Distribution Co., Ltd.** (61,592).—This company's annual return was filed on June 15th, when 2,507 shares had been taken up out of a nominal capital of £50,000 in 5,000 shares of £10 each. £10 per share has been called up, resulting in the receipt of £25,070. Mortgages and charges: Nil.

**Perth Electric Tramways, Ltd.** (55,935).—This company's annual return was filed on May 10th, when the entire capital of £200,000 in 160,000 ordinary and 100,000 preference shares of £1 each had been taken up and paid for in full. Mortgages and charges: £233,832.

**Accumulator Syndicate, Ltd.** (52,514).—This company's annual return, made up to December 31st, 1905, was filed on April 7th, 1906. The entire capital of £30,000 in £1 shares has been taken up. £5,000 has been received, and £25,000 is considered as paid. Mortgages and charges: £375.

**Sheerness and District Electric Power and Traction Co., Ltd.** (65,749).—This company's annual return was filed on June 7th, when the entire capital of £50,000 in £10 shares had been taken up and paid for in full. Mortgages and charges: £15,000.

**Cuba Submarine Telegraph Co., Ltd.** (4,710C).—This company's annual return was filed on May 9th, when the entire capital of £220,000 in 22,000 shares of £10 each had been taken up and paid for in full. Mortgages and charges: Nil.

**Metropolitan Electric Supply Co., Ltd.** (25,395).—This company's annual return was filed on April 12th, when 200,000 ordinary, and 76,121 preference shares had been taken out of a nominal capital of £1,500,000 in 200,000 ordinary, and 100,000 preference shares of £5 each. £5 per share has been called up on 195,936 ordinary, and 76,121 preference, resulting in the receipt of £1,360,285. £20,320 is considered as paid on 4,064 ordinary shares. Mortgages and charges: £470,000.

**Gent & Co., Ltd.** (electricians, Leicester) (78,797).—Issue on June 11th of £1,000 5 per cent. second mortgage debentures, part of series created May 22nd, 1905, to secure £6,500 charged on the company's undertaking and property, present and future, including uncalled and unpaid capital. No trustees. Previously issued of same series; £5,500.

**Andrews & Mumford, Ltd.** (electricians, London) (88,836).—A debenture, dated June 6th, 1906, to secure £300, charged on the company's undertaking and property, present and future, including uncalled capital, has been registered. Holder: C. E. Mumford.

**County of Durham Electrical Power Distribution Co., Ltd.** (61,591).—This company's annual return was filed on April 5th, when the entire capital of £500,000 in 50,000 preference and 50,000 ordinary shares of £5 each had been taken up; £5 per share has been called up on 50,000 preference and 10,000 ordinary, and £3 per share on 40,000 ordinary, resulting in the receipt of £381,220; £38,780 remains unpaid (call of £1 per share made only a fortnight before date of return and not payable till April 19th). Mortgages and charges: Nil.

**Automatic Electric Co., Ltd.** (82,897).—This company's annual return was filed on April 9th, when 606 ordinary and 100 preference shares had been taken up out of a nominal capital of £1,000 in 900 ordinary and 100 preference shares of £1 each; £1 per share has been called up on 106 ordinary and 100 preference, resulting in the receipt of £205; £1 remains in arrears; 500 ordinary shares are considered as fully paid. Mortgages and charges: £30.

**Cycle Electric Lamp, Ltd.** (50,591).—This company's annual return, made up to May 1st, 1905, was filed on April 4th, 1906. The entire capital of £30,000 in £10 shares has been taken up. £10 per share has been called up on 275, and £2,350 has been received. £400 remains in arrears. £27,250 is considered as paid on 2,725. Mortgages and charges: Nil.

**British Power Co., Ltd.** (64,780).—A trust deed dated May 11th, 1906, to secure £50,000 debenture stock created by resolution of even date, has been registered. Property charged: The company's undertaking and property, present and future, including uncalled capital, subject to any subsisting charge. Trustees:—A. T. Ashwell, Nottingham; and W. M. Bell, Dean's Yard, Westminster.

**Mann, Egerton & Co., Ltd.,** electrical engineers, Norwich, Lowestoft and Ipswich (83,780).—Issue on May 29th of £300 5 per cent. debentures, part of series created April 1st, 1905, to secure £10,000, charged on the company's assets and undertaking, including freehold and leasehold property in Norwich and Ipswich. Trustees: C. F. Buxton, Dunster House, Norfolk; and J. J. D. Payne, Eaton Grove, Norwich. Previously issued of same series: £9,400.

**Willans & Robinson, Ltd.** (40,660).—This company's annual return was filed on May 2nd, when 56,666 preference and 66,666 ordinary had been taken up out of a nominal capital of £750,000 in 75,000 preference and 75,000 ordinary shares of £5 each. £5 per share has been called up on 52,208 preference and 52,204 ordinary, resulting in the receipt of £522,035. £144,625 is considered as paid on 14,463 preference and 14,462 ordinary. Mortgages and charges: £246,549.

**West Coast of America Telegraph Co., Ltd.** (52,114).—This company's annual return was filed on May 31st, when 45,008 shares had been taken up out of a nominal capital of £132,520 in 53,008 shares of £2 10s. each. £2 10s. per share has been called up on 8, resulting in the receipt of £20. £112,500 is considered as paid on 45,000 shares. Mortgages and charges: £170,000.

**Wycombe Borough Electric Light and Power Co., Ltd.** (53,133).—This company's annual return, made up to April 25th, has been filed. 8,000 shares have been taken up out of a nominal capital of £50,000 in 10,000 shares of £5 each; £5 per share has been called up, resulting in the receipt of £40,000. Mortgages and charges: £32,100.

**W. E. Dove & Co., Ltd.** (72,630).—This company's annual return was filed on April 12th, when 235 shares had been taken up out of a nominal capital of £2,500 in 250 shares of £10 each. £10 per share has been called up on 115, resulting in the receipt of £1,150: £1,200 is considered as paid on 120 shares. Mortgages and charges: £850.

## CITY NOTES.

### Electric and General Investment Co.

The meeting was held on Wednesday last week at Winchester House, Old Broad Street. Mr. George Herring, who presided, in proposing the adoption of the report, said it was not often that the chairman of a company had to apologise for a 15 per cent. dividend, but they had been accustomed to 30, 40 and 50 per cent. so that he was obliged to apologise for their only paying 15 per cent. this year. Really they had had a very good year, but the difficulty they were under was that the depression in electrical securities was so great that they had been obliged to put aside a sum of money to the contingencies fund, that otherwise they would have distributed as dividend. Unfortunately, all electrical and traction securities at the present time were in a very depressed state. He did not agree that the price was at all equivalent to the worth of those securities, but as prudent men the directors were bound to take notice of the fact that the shares were in that depressed state, and, therefore, they had mentally valued the securities, and instead of paying a larger dividend than 15 per cent., they had carried £5,861 to the contingencies fund. However low their securities were quoted on the Stock Exchange, with one small exception they received dividends on all their investments, and, therefore, though their capital had to a certain extend decreased by depreciation, their income remained very nearly the same as it had been for the last year or two. Having regard to the present value of their securities, the contingency fund was now of an ample amount—in fact, he was not certain that they had not over provided in that respect. The gross profit last year was £13,000, and this year it was £15,900, so that really they had had a better year.

Mr. Emile Garcke seconded the motion, and the report was adopted.

### New General Traction Co.

Baron E. B. d'Erlanger presided on 4th inst. at the meeting held at 20, Bishopsgate Street Within. In moving the adoption of the report, he said that they had again reduced the general expenses, which were now £1,899, against £2,586 in 1905. The debenture interest had increased, but the interest on loans had slightly decreased. The company's interest in the Mexborough and Swinton tramway undertaking had been sold at a net loss of £3,948, and this had been debited to profit and loss account. The year's income from the different electric tramway companies in which they were interested amounted to £14,127, against £9,878 in the preceding year. To meet the Mexborough loss of £3,948, that amount had been transferred from the special reserve account, leaving a balance of £3,004 loss for the year. The reserve account had been reduced to £3,574. On the credit side of the balance-sheet, the shares and bonds belonging to the company had increased by, approximately, £8,000, the difference being represented by securities received from Philadelphia. Whilst their expenditure on the Coventry contract only stood at £4,935 in the accounts for March, 1905, it now stood at £22,850, which was a debt of the Coventry Co. to the New General Traction Co., and which was being paid off gradually out of profit. Since last year they had further remitted £5,883 to Philadelphia. In reviewing the different undertakings in which they were interested, he prefaced his remarks by saying that, although the income from these undertaking had shown an increase over the revenues of the previous year, they had not come up to expectations. Whilst they had only increased their dividend in Coventry Electric Tramways from 2 per cent. to 3 per cent., that company had been able to pay off during 1905 £2,000 of its indebtedness, which, whilst that payment benefited the New General Traction Co., did not enter into the profit and loss account. The Coventry Electric Tramways Co. was making very substantial progress, and the gross receipts for the six months ended June 30th, 1906, showed an increase of, approximately, £3,160 over the corresponding period of 1905. He was sorry to say that the Norwich Electric Tramway Co. was not making the same satisfactory progress. There seemed to be no revival of trade at all in Norwich, and the dividend had only been 2½ per cent. for the year ended June, 1905, against 3 per cent. for the preceding year. Everything had been done in that company, in the face of innumerable difficulties, to keep up traffic and to keep down expenses, but, so far, without much success. The Douglas Southern Electric Tramways results were more or less the same as the preceding year. Six per cent. dividend was paid on the preference shares. The receipts from the Philadelphia enterprise for 1905, as compared with 1904, had been substantially the same, the betterment in the equipment and the arrangement for improving the traffic having been completed too late to bear any fruit in 1905. Mr. Hopkins paid a visit to the United States, and arrangements were now in course of completion which would make a very substantial difference in the revenue to be derived from that property. They had received an offer from one of the largest tramway companies in the United States to take over the whole of their systems near Philadelphia on a long lease, on terms which would secure to this company the regular payment of interest at the rate of 4½ per cent. per annum on the £170,000 of bonds which it held, and a dividend on the shares of £139,000, which they held in the Philadelphia undertaking, as from July 1st, 1906, at the rate of 1 per cent., for 1907 and 1908 2 per cent., for the year 1909 3 per cent., for 1910 4 per cent., and for 1911 and thereafter 5 per cent. per annum. They had every reason to believe that before the end of August they would be in a position to inform them that the transaction had been completed and the actual conditions and terms of the contract settled.

The report was adopted.

### Electrical Power Storage Co.

The directors' report to May 31st, 1906, states that the profit for the year, including the balance of £711 brought forward, is £9,315. Out of this sum the directors have carried £1,000 to the contingent fund, and have written off £2,500 in respect of patents, goodwill, &c. They again recommend the payment of a dividend of 6 per cent. on the ordinary share capital, which will absorb £5,390, and leave £425 to be carried forward. The buildings, plant, tools, &c., have been maintained in thorough repair and condition at a cost of £3,663, which sum has been provided out of revenue. It affords the directors pleasure to be able to record a successful year, notwithstanding the exceptional rise in the price of raw materials and the keen competition which still prevails.

The meeting was to be held yesterday.

### The United River Plate Telephone Co.

The twentieth annual ordinary general meeting of this company was held on Tuesday at Winchester House, Old Broad Street, E.C., Mr. J. Irving Courtenay (chairman) presiding.

In moving the adoption of the report and accounts, the Chairman said that the all-round growth of prosperity in Argentina which had been noticeable ever since the settlement of the Chilian boundary question, and which had been so greatly increased by the exceptionally good crops and high prices of produce during the past two years, had naturally not been without its corresponding beneficial effect upon the business of the company, more especially during the financial year ended March 31st last. Never before had the company's services been in such demand either in Buenos Ayres, La Plata, Rosario, Cordoba, Bahia Blanca, or any of the towns to which their lines extended, or where they had local installations, and adequately to meet the growing requirements of the business and the demands of their subscribers and the public, they had found it necessary to expend a large amount of capital. The company's position was therefore being strengthened, for in the case of subway construction, purchase of real estate and common battery installation, the expenditure must be considered as securely and substantially invested. There had, of course, been the usual concomitants of great prosperity—a rise in prices, higher rents, &c., involving higher wages to the employés, and they had had to contend with occasional strikes. He intended visiting Buenos

Ayres in the latter part of this month for the purpose of personal conference with the company's local representatives. Since his last visit numerous and important additions and improvements had been carried out. Among them was the main trunk line between Buenos Ayres and Rosario and local lines to towns en route. The subway construction was a very valuable work, not only as a protection against the losses caused by storms injuring the overhead wires, but also as a protection against induction from light and power lines. It was also the surest method of planting the company solidly in a city. Further exchange construction and extensions, including the opening of new exchanges at several towns, and the gradual installation of the newest and most efficient types of switchboards at existing exchanges, had rendered necessary the purchase of real estate for the new exchanges and extension of the existing buildings. At the present moment the company had work in progress in towns and districts which might be described roughly as being dotted along an area stretching from Cordoba to Bahia Blanca. Subscribers had increased continuously, and the company had had much difficulty in supplying quickly enough all sorts of telephone plant and in coping with the demand. The capital had been increased by £50,000 by the issue of 10,000 new ordinary shares in July, 1905, and they had added £15,000 to their reserve fund and a like amount to the renewals of plant account. They had £93,028 additional expenditure on the credit side, which was accounted for by the numerous improvements and additions. Real estate had increased by £7,192. Their securities were £19,812 less than in the last balance-sheet, as they had during the year to realise certain of their investments to meet the capital expenditure. Upon the remainder at market prices they had a very satisfactory margin to the good. Receipts in the River Plate showed an increase of practically £30,000, while maintenance charges and general expenses were, roughly, £21,000 more than before. The net profit for the year was £7,823 better than the previous year, and the directors recommended a final dividend of 5 per cent. on the ordinary share capital, making with the interim dividend paid on December 30th last a return of 8 per cent. for the year, free of income-tax.

Mr. George Keith seconded the motion, and it was adopted. An issue of £100,000 in ordinary shares was agreed to.

## National Telephone Co.

The directors' report for the half-year ended June 30th says that the income accrued in respect of the business of the half-year amounts to £1,195,686, as compared with £1,086,381 for the corresponding period of 1905, being an increase of £109,305. The working expenses for the half-year amount to £696,193 as compared with £627,315 for the corresponding period of 1905, being an increase of £68,879. The net result for the half-year (after deducting the Post Office royalties amounting to £113,365) is a profit balance of £386,128 as compared with £358,477 for the corresponding period of 1905, being an increase of £27,650. The rentals carried forward for unexpired terms of running contracts amount to £1,106,639 as compared with £1,018,882 at the corresponding period of 1905, being an increase of £87,757. Out of the available balance of £293,484 shown by the net revenue account the board recommend the payment for the half-year of a dividend at the rate of 6 per cent. per annum on the first and second preference shares, 5 per cent. per annum on the third preference shares, 6 per cent. per annum on the preferred stock, and 5 per cent. per annum on the deferred stock, less income-tax in all cases. The board also propose to transfer £120,000 to the reserve fund, and to carry forward the balance of £10,859. The sum of £608,408 has been expended on capital account during the half-year in the erection of 24,210 additional exchange and private stations, and in the construction of underground works. Following the intimation conveyed to the last half-yearly meeting, Sir Henry Fowler resigned his position as a director of the company, consequent upon his acceptance of office in His Majesty's Government. The board desires to gratefully record its warm appreciation of the signal services rendered by him to the company as director, vice-president and president respectively. Mr. George Franklin has been elected president, and Mr. Samuel Herrick Sands vice-president.

## British Continental Electricity Co.

The directors' report for the year 1905-6 states that 86 new installations (2,405 8-c.p. equiv.) have been connected. The receipts from sale of current show an increase of £988 over those of the preceding year. Unfortunately the net profit has been very greatly reduced owing to the embezzlement of a sum of £422 by the company's cashier, of which sum £213 has been written off revenue. The remainder the directors have written off from the difference in exchange reserve account, reducing this to £250, which, having in mind the greatly increased prosperity in Italy, they consider an ample amount to meet any adverse fluctuations in the rate of exchange. After writing off £137 as depreciation in respect of furniture, tools, meters, &c., £75, as usual, from preliminary expenses, £100 as depreciation of plant, and £213 the balance of the amount embezzled by the company's cashier, together with the sum of £239, for the unexercised option above referred to, the balance standing to the credit of revenue account, including the sum brought over from last year, is £596. Out of this the directors recommend a dividend at the rate of 5½ per cent. per annum on the 5½ per cent. cum. pref. shares for the past year, £550, leaving a balance to be carried forward of £46. The directors are now making arrangements to pay the back dividends on the preference shares, which will be the subject of a special circular shortly to be issued. The sum of £567 has been spent on new plant and meters during the year.

## Telegraph Construction and Maintenance Co.

The half-yearly meeting was held at 38, Old Broad Street, E.C., on Tuesday, Mr. Wm. Shuter presiding.

The Chairman said that the affairs of the company continued in a satisfactory condition. According to their ordinary custom, they had to announce that the interim dividend of 5 per cent. would be paid that day. He was happy to be able to tell them that they had done a good deal of work during the six months. Both factories had been running overtime, and the ships had been employed on cable repairs, and had still important engagements to fulfil. Although their output had been large for the six months, he must call their attention to the fact that the prices had been very closely cut, and they had now to be content with very small profits. This should not in any way discourage them, as, fortunately, in the golden time of their prosperity they were able to make preparation by reconstructing, &c., their works, as well as renewing the ships and bringing them up to date in efficiency and economy. That had been done without calling upon the shareholders for any increase in capital. They were thus very favourably placed for meeting competition in the future. The directors were perfectly satisfied with the present condition of the company.

The meeting closed with a vote of thanks to the board and staff.

## Electric Construction Co.

The directors' annual report states that the profits available for distribution amount to £6,045, and the directors recommend payment (on July 31st next) of the dividend on the preference shares which will absorb £4,395, and leave to be carried to next account a balance of £1,651. The buildings and plant have, as formerly, been thoroughly maintained out of revenue, and £5,000 has been credited to depreciation account, which now amounts to £63,000, while the general reserve fund stands at £32,000. The output of the Bushbury Works has during the past year been increased, but the intense competition that has prevailed, and still continues, has so reduced prices that, notwithstanding strict economy and improved efficiency, the margin of profit is not sufficient to provide a dividend on the ordinary shares. Among the important contracts practically completed may be mentioned the London County Council installation at Greenwich, where the generators are the largest in this country, and the installation for the Great Western Railway Co. at Park Royal to provide electric current for operating their suburban traffic. The falling off in the return from "Shares in other Companies," is due to a reduction of the dividend paid by the Madras Tramways owing to the failure of the monsoon in 1905, and to an outbreak of plague in the city, but the traffic is now rapidly improving.

**Prospectus.**—*De Mello Brazilian Rubber Co., Ltd.*—The list is to close to-day in an issue of 270,000 ordinary shares (£1). The estates carry great quantities of rubber trees in full bearing. The average production for the past five years was 300 tons of Para rubber; last year it was 383 tons. Among the directors we observe Mr. James O. Callender (of Callender's Cable Co), Mr. W. B. Hopkins (of Edmundson's), M. Lazare Weiller, and Mr. Chas. Steel (Great Northern & City Railway).

**Meldrum Bros.**—The *Financial Times* says that the directors of this company regret that in view of the loss shown in the accounts for the year ended December 31st last (when the 5½ per cent. preference dividend was met for the year), they are not justified in declaring an interim dividend on these shares for the six months ended 30th ult.

**W. & T. Avery.**—The net profit for the past year amounts to £25,733. It is proposed to pay a 10 per cent. dividend on the ordinary shares.

**Rosario Electric Co.**—At an extraordinary general meeting held on 6th inst. at River Plate House, Mr. W. T. Western presiding, a resolution was passed increasing the capital to £260,000 by the creation of 20,000 second preference shares of £5 each. The chairman stated that, in the three years of their existence they had more than trebled the number of their customers, and the business had been brought to the point of earning a respectable dividend. They had made a mistake in not building a larger plant at the outset. A new dynamo had been sent out and the directors desired to order another. Distributing cables were also needed. The time had come when it was desirable to install a condensing plant.

**Stock Exchange Notices.**—The Committee has appointed special settling days as under:—

Wednesday, July 18th.—Buenos Ayres Port and City Tramways—Provisional certificates (fully and partly paid) for £200,000 6 per cent. first mortgage debenture stock.

Canadian General Electric Co.—London certificates for 11,000 common shares of $100 each, fully paid.

Thursday, July 19th.—Electrical Development Co., of Ontario.—$2,500,000 5 per cent. first mortgage 30-year gold bonds of $500 each, Nos. 10,751 to 15,750.

The first and last of these are to be quoted officially.

**Bukit Rajah Rubber Co.**—For the year ended March 31 last a dividend at the rate of 6 per cent. on the ordinary shares is to be paid. The total number of trees at March 31st last was 195,571, of which 34,457 were tapped during the year. The yield of rubber amounted to 33,203 lb., which realised a gross price of 5s. 5d. per lb. The manager estimates a crop of 80,000 lb. for the current year.

## MARKET QUOTATIONS.

### Wednesday, July 11th.

| CHEMICALS, &c. | | Latest Price. | Fortnight's Inc. or Dec. |
|---|---|---|---|
| *a* Acid, Hydrochloric .. .. | per cwt. | 5/- | .. |
| *a* „ Nitric .. .. .. .. | per cwt. | 22/- | .. |
| *a* „ Oxalic .. .. .. .. | per cwt. | 32/- | .. |
| *a* „ Sulphuric .. .. .. | per cwt. | 5/6 | .. |
| *a* Ammoniac, Sal .. .. .. | per cwt. | 42/- | .. |
| *a* Ammonia, Muriate (crystal) .. | per ton | £33 10 | .. |
| *a* „ „ .. .. .. | per ton | £30 | .. |
| *a* Bleaching powder .. .. .. | per ton | £5 10 | .. |
| *a* Bisulphide of Carbon .. .. | per ton | £18 | .. |
| *a* Borax .. .. .. .. .. | per ton | £15 | .. |
| *a* Benzole (90 %) .. .. .. | per gal. | 10½d. | .. |
| *a* „ (50 %) .. .. .. | per gal. | 10d. | .. |
| *a* Copper Sulphate .. .. .. | per ton | £26 | .. |
| *a* Lead, Nitrate .. .. .. | per ton | £28 | .. |
| *a* „ White Sugar.. .. .. | per ton | £31 | .. |
| *a* „ Peroxide .. .. .. | per ton | £27 10 | .. |
| *a* Methylated Spirit .. .. .. | per gal. | 2/6 | .. |
| *a* Naphtha, Solvent (90 % at 160° C) | per gal. | 5/6 | .. |
| *a* Potassium Bichromate, in casks | per lb. | 3½d. | ½d. inc. |
| *a* Potash, Caustic (75/80 %) .. | per ton | £20 | .. |
| *a* Potassium Cyanide .. .. | per lb. | 7½d. | .. |
| *a* Shellac .. .. .. .. | per cwt. | 200/- | .. |
| *a* Sulphate of Magnesia .. .. | per ton | £4 10 | .. |
| *a* Sulphur, Sublimed Flowers .. | per ton | £6 10 | .. |
| *a* „ Recovered .. .. | per ton | £5 10 | .. |
| *a* „ Lump .. .. .. | per ton | £5 | .. |
| *a* Soda, Caustic (white 70 %) .. | per ton | £10 15 | .. |
| *a* „ Crystals .. .. .. | per ton | £3 5 | .. |
| *a* Sodium Bichromate, casks .. | per lb. | 2½d. | .. |
| *a* „ Cyanide .. .. .. | per lb. | 7d. | .. |
| **METALS, &c.** | | | |
| *b* Aluminium Ingots, in ton lots .. | per ton | £160 | .. |
| *b* „ Wire, in ton lots .. | per ton | £191 | .. |
| *b* „ Sheet, in ton lots .. | per ton | £177 | .. |
| *b* Babbitt's metal ingots .. .. | per ton | £43 to £140 | .. |
| *c* Brass (rolled metal 2" to 12") basis | per lb. | 9½d. | .. |
| *c* „ Tube (brazed) .. .. | per lb. | 10½d. | .. |
| *c* „ „ (solid drawn).. .. | per lb. | 10d. | .. |
| *c* „ Wire, basis .. .. .. | per lb. | 9½d. | .. |
| *c* Copper Tubes (brazed) .. .. | per lb. | 1/- | .. |
| *c* „ „ (solid drawn) .. | per lb. | 1/0½ | .. |
| *g* Copper Bars (best selected) .. | per ton | £97 | .. |
| *g* Copper Sheet .. .. .. | per ton | £97 | .. |
| *g* „ Rod .. .. .. .. | per ton | £97 | .. |
| *e* „ (Electrolytic) Bars .. | per ton | £92 | .. |
| *e* „ „ Sheets .. | per ton | £104 | .. |
| *e* „ „ Rod .. | per ton | £95 | .. |
| *e* „ „ H.C. Wire | per lb. | 11d. | .. |
| *f* Ebonite Rod .. .. .. | per lb. | 3/3 | .. |
| „ Sheet .. .. .. | per lb. | 3/- | .. |
| *n* German Silver Wire .. .. | per lb. | 1/7 | .. |
| *h* Gutta-percha, fine .. .. | per lb. | 6/- to 7/- | .. |
| *h* India-rubber, Para fine .. .. | per lb. | 5/0½ to 5/1½ | dec. |
| *i* Iron, Charcoal Sheets .. .. | per ton | £18 | .. |
| *i* „ Pig (Cleveland warrants) | per ton | 50/4 | 7d. inc. |
| *i* „ Forgings, according to size | per ton | From £11 | .. |
| *i* „ Scrap, heavy .. .. | per ton | 47/6 to 50/- | .. |
| *i* „ Wire, galvanised No. 8 .. | per ton | £9 15 | .. |
| *g* Lead, English Ingot .. .. | per ton | £16 10 to £16 15 | 5/- dec. |
| *g* „ „ Sheet .. .. | per ton | £18 10 to £18 12 6 | 5/- dec. |
| *m* Manganin Wire No. 28 .. .. | per lb. | 8/- | .. |
| *g* Mercury .. .. .. .. | per bot | £7 5 | .. |
| *d* Mica (in original cases) small .. | per lb. | 6d. to 1/- | .. |
| *d* „ „ „ medium | per lb. | 2/6 to 4/- | .. |
| *d* „ „ „ large .. | per lb. | 4/6 to 8/6 | .. |
| *p* Phosphor Bronze, plain castings | per lb. | 1/1 to 1/3 | .. |
| *p* „ rolled bars & rods | per lb. | 1/1½ to 1/3 | .. |
| *p* „ „ strip & sheet | per lb. | 1/4 | .. |
| *o* Platinum .. .. .. .. | per oz. | nominal | .. |
| *e* Silicium Bronze Wire .. .. | per lb. | 1/- to 1/1 | .. |
| *i* Steel, Magnet, acc'd'g to desc'p'n | per ton | £58 | .. |
| „ „ in bars .. .. | | £15 to £40 | .. |
| *g* Tin, Block (English) .. .. | per ton | £166 to £167 | 12/7 dec. |
| *n* „ Wire, Nos. 1 to 16 .. .. | per lb. | 2/2½ | .. |
| *p* White Anti-friction Metals— | | | |
| "White Ant" brand .. .. | per ton | £46 to £70 | .. |
| *j* Yarns, 2/10s Grey Cotton, on sp'ls | per lb. | 9d. | .. |
| *j* „ 6 lea. Flax .. .. | per lb. | 6d. | .. |
| *j* „ 3 ply 10 lbs. Russian .. | per lb. | 5½d. | .. |
| *j* „ 10 lbs. Russian, single .. | per lb. | 5½d. | .. |
| *j* „ 180 lbs. Jute rove .. | per ton | £18 | .. |
| *k* Zinc, Sh't (Vieille Montagne bnd.) | per ton | £32 | .. |

Quotations supplied by:—

*a* G. Boor & Co.
*b* The British Aluminium Co., Ltd.
*c* Thos. Bolton & Sons, Ltd.
*d* F. Wiggins & Sons.
*e* Frederick Smith & Co.
*f* India-Rubber, G.P. and Teleg. Works Co., Ltd.
*g* James & Shakspeare.
*h* Edward Till & Co.
*i* Bolling & Lowe.
*j* Walter H. Hindley & Co., Ltd.
*k* Morris Ashby, Ltd.
*m* W. T. Glover & Co., Ltd.
*n* P. Ormiston & Sons.
*o* Johnson, Matthey & Co., Ltd.
*p* The Phosphor Bronze Co., Ltd.

**Cryselco, Ltd.**—We are informed that at the eighth ordinary general meeting, held on July 2nd, a dividend of 10 per cent. was declared, with a balance forward of £2,148. The directors reported a steady increase in the business of the company, and, notwithstanding the great competition, they had on hand amongst others a three years' contract for the War Office, and contracts with the Admiralty, the chief railways and many corporations.

**Eastern Telegraph Co.**—The directors recommend a final dividend of £1 5s. per cent., and a bonus of £2 per cent., making a total distribution of 7 per cent. on the ordinary stock for the year ended March 31st, 1906. This is the same rate as for last year.

## STOCKS AND SHARES.

Tuesday Evening.

Dulness continues the keynote of the markets in the Stock Exchange. What little business is doing takes the form principally of sales, and the steady liquidation of investment securities must perforce go on until the weak speculative accounts get closed up. The real distress that prevails in a certain section of the Stock Exchange is another reason for the sales of such securities, and with the generally unsettled outlook, as it has been observed previously, investors require a good deal of persuasion before they will buy stocks and shares, especially those in the electricity departments.

Supply shares maintain their levels without much change. Charing Cross Preference and City of London Preference are both ¼ lower at 4¼ and 12¾ respectively. On the other hand, Urban Ordinary continue to advance, with a rise of ⅛, which makes 7s. 6d. improvement in the fortnight. Metropolitan Preference recovered half of their last week's fall, and there the list of alterations ends. The market for these supply shares will, no doubt, be unsettled during the next nine months at least, unless some definite form of arrangement is advanced whereby the companies are assured of a fair profit, whatever the authority may be which will in time supply London with electric power. But in the market there is less pessimism than prevailed earlier this year, and the possibility of an electric lighting board is again discussed as a factor which might assist prices if it were to materialise.

Central London traffics fail to revive, and it is now admitted that the motor-omnibus competition does the company a good deal of harm. During the dog-days the overhead method of travelling is too attractive for the "tubes" not to feel the swift-running motor-'buses severely, and the latest news is that an American concern will put a fresh service of electric motor-'buses on the London roads this autumn. Parenthetically, it is somewhat amusing to notice how the Society papers are lashed into indignation over the invasion of West End thoroughfares by the evil-smelling, noisy, popular motor-'bus, although they maintain a discreet silence upon the damage done to cycling, pedestrianism, and even to the value of house-property by the notorious manners of a certain large section of motorists.

Metropolitan Consolidated at 65½, and District Ordinary at 24½, are both suffering from the heat—which drives traffic to open-air routes, but City and South London has recovered to 41. The approaching completion of the Euston extension has drawn a little attention to the stock. The dividend is estimated at the rate of 2 per cent. The Baker Street and Waterloo line is still faring ill, its traffics being about £1,450 a week. Great Northern and City Preferred "A" shares are down to 3½.

Traction descriptions have not moved much either way. British Electric Second Debenture shed a point, Anglo-Argentine Ordinary fell 1/16, and the weakness has continued in Calcutta Trams.

We are informed that the South Wales Electric Power Co. has received the necessary proportion of assents to obtain Parliament's permission for the proposed new issue of prior-lien debentures, but we mention this for what it may be worth. There is a little negotiation, rather than dealing, in the shares, and we hear that there are buyers of the Ordinary at nine shillings, although sellers are asking four times as much.

National Telephone varieties are quietly bought, the Deferred and the two Debenture stocks registering rises of ½ per cent. each. The Telegraph groups are slightly lower on balance. Anglo "A" has lost ⅞ at 22¾, and the Ordinary stock is ½ lower. Great Northern shares are this amount up, and so are Telegraph Constructions at 33½. Eastern Telegraph Ordinary shed a point.

In the manufacturing division, Willans & Robinson Ordinary are dull at 25s., Dick, Kerrs are a little down, and Callender's Debenture is two points to the good.

**St. James' and Pall Mall Electric Light Co.**—The directors have declared an interim dividend on the preference shares at the rate of 7 per cent. per annum, and on the ordinary shares at the rate of 10 per cent. per annum, for the half-year ending June 30th. These are the same rates as for the corresponding half of last year. The share transfer books will be closed from July 18th to 31st inclusive.

**Direct United States Cable Co.**—The board recommends a final dividend of 4s. per share, together with a bonus of 2s. 6d. per share, both free of income-tax (payable on and after the 31st inst.), making with the three interim dividends already paid, a total distribution of 4¼ per cent. for the year ended June 30th last, carrying forward a balance of about £6,316. The total distribution for the preceding year was 3¾ per cent.

# SHARE LIST OF ELECTRICAL COMPANIES.

## TELEGRAPH AND TELEPHONE COMPANIES.

| Present Issue. | NAME. | Stock or Share. ‡ | Dividends for the last four years. 1902. | 1903. | 1904. | 1905. | Closing Quotations July 3rd. | Closing Quotations July 10th. | Business done week ended July 10th, 1906. Highest | Lowest. | Rise + or Fall — |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 25,000 | Amazon Telegraph Co.'s shares, Nos. 1 to 25,000 | 10 | Nil | Nil | Nil | .. | 3 — 3½ | 3 — 3½ | .. | .. | .. |
| 155,600 | Do. do. 5 % Debs., Nos. 1 to 1,250 Red. | 100 | Nil | Nil | Nil | 5 % | 80 — 85 xd | 80 — 85 xd | 80½ | .. | .. |
| 702,600 | Anglo-American Telegraph .. .. .. | Stock | 60/6 | 61s. | 23/6 | 8½ | 65/- — 67/6 | 65 — 67 | 66⅝ | 65¾ | — ⅛ |
| 8,148,700 | Do. do. do. 6 % Pref. .. .. | Stock | 6 % | 6 % | 6½ % | 6 % | 112½—113½ | 112 —113 | 112¾ | 111⅞ | — ⅛ |
| 8,148,700 | Do. do. do. Deferred .. .. | Stock | 1/- | 2s. | Nil | ½ % | 23/6 — 23/9 | 22/6 — 22/7 | 23/- | 22/10 | — ⅛ |
| 50,000 | Anglo-Portuguese Tel., 5% Mort. Deb. Stock Red. | 100 | .. | .. | .. | .. | 101 —103 | 101 —103 | .. | .. | .. |
| 44,000 | Chili Telephone, Nos. 1 to 44,000 .. .. .. | 5 | 6 % | 7 % | 8 % | 8 % | 7⅞ — 8¼ | 7⅞ — 8¼ | .. | .. | .. |
| 1,922,855 | Commercial Cable Stng. 500 year 4 % Deb. Sk. Red. | Stock | 4 % | 4 % | 4 % | 4 % | 97 — 99 xd | 97 — 99 | 98⅞ | 98 | .. |
| 16,000 | Cuba Telegraph .. .. .. .. .. | 10 | 6¾ % | 10 % | 5 % | 5 % | 8½ — 9 | 8½ — 9 | .. | .. | .. |
| 6,000 | Do. 10 % Pref. .. .. .. .. | 10 | 10 % | 5 % | 10 % | 10 % | 17 — 18 | 17 — 18 | .. | .. | .. |
| 12,931 | Direct Spanish Telegraph, Ord. .. .. .. | 5 | 4 % | 4 % | 4 % | 4 % | 3⅜ — 3⅝ | 3⅜ — 3⅝ | .. | .. | .. |
| 6,000 | Do. do. 10 % Cum. Pref. .. .. | 5 | 10 % | 10 % | 10 % | 10 % | 8½ — 9 | 8½ — 9 | .. | .. | .. |
| 80,000 | Do. do. 4½ % Debs. .. .. | 50 | 4½ % | 4½ % | 4½ % | 4½ % | 98 —101 xd | 98 —101 | .. | .. | .. |
| 60,710 | Direct United States Cable .. .. .. | 20 | 8½ % | 5 % | 8½ % | 8½ % | 15½ — 16 | 15½ — 16 | 15⅝ | 15½ | .. |
| 65,500 | Direct W. India Cable, 4½ % Reg. Deb., 1 to 1,200, R. | 100 | 4½ % | 4½ % | 4½ % | 4½ % | 99½ —101½ xd | 99½ —100½ | .. | .. | .. |
| 4,000,000 | Eastern Telegraph, Ord. Stock .. .. .. | Stock | 7 % | 7 % | 7 % | 7 % | 142 —145 | 141 —144 | 143½ | 141½ | —1 |
| 2,000,000 | Do. 3½ % Pref. Stock .. .. .. | 100 | 3½ % | 3½ % | 3½ % | 3½ % | 90 — 92 | 90 — 92 | 91⅝ | 90⅝ | .. |
| 1,848,772 | Do. 4 % Mort. Deb. Stock Red. .. | Stock | 4 % | 4 % | 4 % | 4 % | 107 —109 | 107 —109 | 107⅞ | 107 | .. |
| 800,000 | Eastern Extension, Australasia, and China Tele. | 10 | 7 % | 7 % | 7 % | 7 % | 14 — 14½ | 14 — 14½ | 14⅝ | 14 | .. |
| 752,400 | Do. 4 % Deb. Stock .. .. .. .. | Stock | 4 % | 4 % | 4 % | 4 % | 105½—107½ | 105½—107½ | 107 | .. | .. |
| 800,000 | East & S. Afric. Tel., 4 % Mtg. Db., 1 to 8,000, red. 1909 | 100 | 4 % | 4 % | 4 % | 4 % | 100 —102 | 100 —102 | .. | .. | .. |
| 200,000‡ | Do. 4 % Reg. M. Debs. (Mauritius Sub.) 1 to 8,000 | 25 | 4 % | 4 % | 4 % | 4 % | 100 —102 | 100 —102 | .. | .. | .. |
| 180,887 | Globe Telegraph and Trust .. .. .. | 10 | £3 | 5½ % | 5⅞ % | 5½ % | 10⅜ — 11⅛ | 10⅜ — 11⅛ | 11 1/16 | 10 13/16 | .. |
| 180,887 | Do. do. 6 % Pref. .. .. | 10 | 6 % | 6 % | 6 % | 6 % | 14⅜ — 14⅝ | 14⅜ — 14⅝ | 14 3/16 | 14⅜ | .. |
| 150,000 | Great Northern Telegraph, of Copenhagen .. | 10 | 12½ % | 15 % | 24 % | 24½ | 39 — 41 | 39½ — 41½ | 40⅝ | 40⅜ | + ⅛ |
| 37,900 | Halifax and Bermudas Cable, 4½ % 1st Mort. Debs., within Nos. 1 to 1,900, Red. | 100 | 4½ % | 4½ % | 4½ % | 4½ % | 99½—101½ xd | 99½ —101½ | .. | .. | .. |
| 17,000 | Indo-European Telegraph .. .. .. | 25 | 10 % | 10 % | 13 % | 13 % | 57 — 59 | 57½ — 59½ | 58⅞ | 58⅜ | + ⅛ |
| 251,127 | Marconi's Wireless Telegraph .. .. .. | 1 | Nil | Nil | Nil | Nil | 1⅛ — 1⅜ | 1⅛ — 1⅜ | .. | .. | .. |
| 72,680 | Monte Video Telephone Co., Ltd. Ord. .. .. | 1 | 3 % | 3 % | 4 % | .. | ⅞ — 1 | ⅞ — 1 | .. | .. | .. |
| 86,492 | Do. do. do. 5 % Pref. .. | 1 | 5 % | 5 % | 5 % | .. | 1/2 — 1 1/16 | 1/2 — 1 1/16 | .. | .. | .. |
| 1,983,333 | National Telephone, Pref. Stock .. .. .. | 100 | 6 % | 6 % | 6 % | 6 % | 110 —112 | 110 —112 | 111½ | 110½ | .. |
| 1,966,667 | Do. do. Def. Stock .. .. .. | 100 | 4½ % | 5 % | 5 % | 5 % | 105½—108½ | 107 —109 | 108½ | 106½ | + ½ |
| 15,000 | Do. do. 6 % Cum. 1st Pref. .. .. | 10 | 6 % | 6 % | 6 % | 6 % | 12 — 14 | 12 — 14 | 12½ | .. | .. |
| 15,000 | Do. do. 6 % Cum. 2nd Pref. .. .. | 10 | 6 % | 6 % | 6 % | 6 % | 10 — 12 | 10 — 12 | 11⅜ | .. | .. |
| 250,000 | Do. do. 5 % Non-cum. 3rd P., 1 to 250,000 | 5 | 5 % | 5 % | 5 % | 5 % | 5½ — 5⅝ | 5½ — 5⅝ | .. | .. | .. |
| 2,000,000 | Do. do. 3½ % Deb. Stock Red. .. | Stock | 3½ % | 3½ % | 3½ % | 3½ % | 96 — 98 xd | 96⅜ — 98⅜ | 97⅞ | 96 | + ⅛ |
| 1,689,593 | Do. do. 4 % Deb. Stock Red. .. | 100 | 4 % | 4 % | 4 % | 4 % | 102 —104 xd | 102⅛ —104⅛ | 104 | 103½ | + ⅜ |
| 179,313 | Oriental Telep. and Elec. 1 to 171,504, fully paid | 1 | 6 % | 6½ % | 6½ % | 7½ % | 1 1/16 — 1 1/16 | 1 1/16 — 1 1/16 | .. | .. | .. |
| 50,000 | Do. do. do. 6 % Cum. Pref. .. | 1 | 6 % | 6 % | 6 % | 6 % | 1⅛ — 1⅜ | 1⅛ — 1⅜ | .. | .. | .. |
| 100,000 | Do. do. do. 4% Red. Deb. Stock | 100 | .. | .. | .. | 4 % | 97 — 99 xd | 97 — 99 | .. | .. | .. |
| 100,000 | Pacific & European Tel., 4 % Guar. Debs., 1 to 1,000 | 100 | 4 % | 4 % | 4 % | 4 % | 99 —102 xd | 99 —102 | .. | .. | .. |
| 11,839 | Reuter's .. .. .. .. .. .. | 8 | 5 % | 5 % | 5 % | 5 % | 7⅛ — 7⅜ | 7⅛ — 7⅜ | 7 1/16 | .. | .. |
| 60,000 | Telephone Co. of Egypt, 4½ % Deb. Red. .. .. | 100 | .. | .. | .. | 4½ % | 101 —104 xd | 101 —104 | .. | .. | .. |
| 3,201 | Submarine Cables Trust .. .. .. .. | Cert. | 6 % | 6 % | 6 % | 6 % | 127 —130 | 127 —130 | 129½ | 129½ | .. |
| 70,000 | United River Plate Telephone .. .. .. | 5 | 7 % | 8 % | 8 % | 8 % | 7 — 7⅛ | 7 — 7⅛ | 7 1/16 | .. | .. |
| 40,000 | Do. 5 % Cum. Pref., Nos. 1 to 40,000 | 5 | 5 % | 5 % | 5 % | 5 % | 5¼ — 5⅜ xd | 5¼ — 5⅜ | .. | .. | .. |
| 179,947 | Do. do. 5 % Debs. .. .. .. .. | Stock | 5 % | 5 % | 5 % | 5 % | 108 —111 xd | 108 —111 | .. | .. | .. |
| 15,609 | West African Telegraph, Shares .. .. .. | 10 | 2 % | 4 % | 4½ % | 4 % | 9½ — 10 xd | 9½ — 10 xd | .. | .. | .. |
| 80,008 | W. Coast of America, 1 to 80,000 & 53,001 to 53,008 | 2½ | Nil | Nil | Nil | Nil | ¼ — ⅜ | ¼ — ⅜ | .. | .. | .. |
| 150,000 | Do. 4 % Debs., 1 to 1,500 guar. by Braz. Sub. Tel. | 100 | 4 % | 4 % | 4 % | 4 % | 99 — 102 xd | 99 —102 | .. | .. | .. |
| 207,980 | Western Telegraph, Ltd., Nos. 1 to 207,930 .. | 10 | 7 % | 7 % | 7 % | 5 % | 14½ — 14⅝ xd | 14½ — 14⅝ | 14½ | 14 5/16 | .. |
| 75,000 | Do. do. 5 %-Debs. 2nd series, 1906 | 100 | 5 % | 5 % | 5 % | 5 % | 101 —103 xd | 101 —103 | .. | .. | .. |
| 563,380 | Do. do. 4 % Deb. Stock Red. .. | 100 | 4 % | 4 % | 4 % | 4 % | 102 —105 xd | 102 —105 | 104½ | .. | .. |
| 88,321 | West India and Panama Telegraph .. .. .. | 10 | Nil | Nil | Nil | .. | ⅜ — ½ | ⅜ — ½ | .. | .. | .. |
| 34,563 | Do. do. 6 % Cum. 1st Pref. .. .. | 10 | 7 %* | 7 %* | 6 % | 5 % | 6 — 7 | 6 — 7 | .. | .. | .. |
| 4,669 | Do. do. 6 % Cum. 2nd Pref. .. .. | 10 | Nil | Nil | Nil | Nil | 4½ — 5½ | 4½ — 5½ | .. | .. | .. |
| 80,000‡ | Do. do. 5 % Debs., Nos. 1 to 1,800 .. | 100 | 5 % | 5 % | 5 % | 5 % | 99 —102 xd | 99 —102 | .. | .. | .. |

* Including arrears.

## ELECTRICAL RAILWAY, MANUFACTURING AND INDUSTRIAL COMPANIES.

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 170,000 | Anglo-Argentine Trams, 260,008 to 430,007 .. .. | 5 | .. | .. | 8 % | 8 % | 6½ — 7 1/16 | 6⅞ — 7 | 7 | 6⅞ | —1/16 |
| 260,007 | Do. 5½ % Cum. Pref., 1 to 260,007 .. | 5 | .. | 5 % | 5 % | 5½ % | 6 — 6 xd | 5⅞ — 6 | 5 13/16 | 5 13/16 | .. |
| 266,600 | Do. Permanent, 6 % Deb. Stock, 1888 | 100 | .. | 6 % | 6 % | 6 % | 138 —141 xd | 128 —141 | 140 | .. | .. |
| 285,100 | Auckland E. Trams., 5 % 1st Mort. Deb. Stock .. | 100 | .. | 5 % | 5 % | 5 % | 102 —104 xd | 102 —104 | 108¼ | .. | .. |
| 800,000 | Babcock & Wilcox, 1 to 580,000 .. .. .. | 1 | .. | 17 % | 20 % | 20 % | 3⅞ — 4 | 3⅞ — 4 | 78/1½ | 77/6 | .. |
| 100,000 | Do. do. 6 % Cum. Pref., 1 to 100,000 .. | 1 | .. | 6 % | 6 % | 6 % | 1½ — 1⅝ | 1½ — 1⅝ | .. | .. | .. |
| 38,000 | British Aluminium, Ord., 2,001 to 40,000 .. .. | 5 | .. | .. | 7 % | 7 % | 3¾ — 4 | 3¾ — 4 | .. | .. | .. |
| 40,000 | Do. do. 7 % Cum. Pref. .. .. .. | 5 | Nil | Nil | 7 % | 7 % | 6 — 6½ | 6 — 6½ | 6¼ | .. | .. |
| 20,000 | Do. do. "A" 6 % Cum. Pref. .. .. | 5 | Nil | Nil | 6 % | 6 % | 6¼ — 6⅝ | 6¼ — 6⅝ | 6 5/16 | .. | .. |
| 20,000 | Do. do. 4 % Funding Certs. .. .. | 5 | .. | .. | 4 % | 4 % | 4 — 4½ | 4 — 4½ | .. | .. | .. |
| 800,000‡ | Do. do. 5 % 1st Mort. Deb. Stock Red. | Stock | 5 % | 5 % | 5 % | 5 % | 100 —104 | 100 —104 | .. | .. | .. |
| 800,000 | British Columbia E. Rail Def. Ord. Stock .. .. | 100 | .. | 6 % | 6 % | 6 % | 115 —118 | 115 —118 | 116¼ | 115 | .. |
| 300,000 | Do. 5 % Pref. Ord. Stock .. .. .. | 100 | .. | 5 % | 5 % | 5 % | 107 —110 | 107 —110 | .. | .. | .. |
| 115,000 | Do. 5 % Cum. Perp. Pref. Stock .. .. | 100 | .. | 5 % | 5 % | 5 % | 107 —110 | 107 —110 | .. | .. | .. |
| 240,400 | Do. 4½ % 1st Mort. Debs., 1 to 6,250 .. .. | 40 | .. | 4½ % | 4½ % | 4½ % | 103 —105 | 103 —105 | .. | .. | .. |
| 220,000 | Do. 4½ % Vancouver Power Debs., 1 to 2,200 | 100 | .. | 4½ % | 4½ % | 4½ % | 103 —106 | 103 —106 | .. | .. | .. |
| 133,991 | British Electric Traction .. .. .. .. | 10 | 3 % | 6 % | 6 % | 3 % | 5⅜ — 6 | 5⅜ — 6 | 5 1/16 | 5⅛ | .. |
| 161,487 | Do. do. 6 % Cum. Pref. .. .. | 10 | 6 % | 6 % | 6 % | 6 % | 9 — 9⅛ | 9 — 9⅛ | 9 1/16 | 9 1/16 | .. |
| 1,415,422 | Do. do. 5 % Perp. Deb. Stock .. | Stock | 5 % | 5 % | 5 % | 5 % | 109 —113 | 109 —113 | 111⅛ | 110⅜ | .. |
| 410,178 | Do. do. 4½ % 2nd Deb. Stock Red. | 100 | .. | .. | 4½ % | 4½ % | 10 — 99 | 89 — 92 | 91½ | 90¼ | —1 |
| 100,000 | British Insulated and Helsby Cables .. .. | 5 | 10 % | 8 % | 8 % | 8 % | 6½ — 7 | 6¾ — 7 | .. | .. | .. |
| 100,000 | Do. do. 6 % Cum. Pref. .. .. | 5 | 6 % | 6 % | 6 % | 6 % | 6¾ — 6¾ | 6¾ — 6¾ | .. | .. | .. |
| 200,000 | Do. do. 4½ % 1st Mort. Deb. Red. | 100 | 4½ % | 4½ % | 4½ % | 4½ % | 102 —105 xd | 102 —105 | 103¼ | .. | .. |
| 212,000 | British Thomson-Houston 4½ % 1st Mort. Debs. .. | 100 | .. | 4½ % | 4½ % | 4½ % | 96 — 98 | 96 — 98 | .. | .. | .. |
| 400,000 | British Westinghouse 6 % Pref., 1 to 200,000 and 275,001 to 475,000 | 5 | .. | 6 % | Nil | .. | 1⅛ — 1⅜ | 1⅛ — 1⅜ | 25/- | 23/9 | .. |
| 1,016,358 | Do. do. 4 % Mort. Deb. Stock .. | 100 | .. | 4 % | 4 % | 4 % | 77 — 83 xd | 77 — 83 | 78 | 77¾ | .. |
| 60,000 | ¶Browett, Lindley & Co., Ord. .. .. .. .. | £1 | Nil | Nil | Nil | .. | 13/- — 14/- | 13/- — 14/- | .. | .. | .. |
| 60,000 | ¶ Do. do. 6 % Cum. Pref. .. .. | £1 | Nil | Nil | Nil | .. | 14/6 to 15/6 | 14/6 to 15/6 | .. | .. | .. |
| 105,781 | Brush Electrical Engineering, Ord., 1 to 105,781 .. | 2 | Nil | Nil | Nil | 2½ % | ⅝ — ¾ | ⅝ — ¾ | .. | .. | .. |
| 150,000 | Do. Non-cum. 6 % Pref. .. .. | 2 | 6 % | 6 % | 6 % | 6 % | 1⅝ — 2 | 1⅝ — 2 | .. | .. | .. |
| 125,000‡ | Do. 4½ % Perp. Deb. Stock .. | Stock | 4½ % | 4½ % | 4½ % | 4½ % | 97 — 99 | 97 — 99 | 98½ | .. | .. |
| 125,000‡ | Do. 4½ % Perp. 2nd Deb. Stock | Stock | 4½ % | 4½ % | 4½ % | 4½ % | 82 — 84 xd | 82 — 84 | .. | .. | .. |
| 100,000 | Buenos Ayres & Belgrano, 1 to 100,000 .. .. | 5 | .. | 3 % | 4 % | 3 % | 3 5/16 — 3 7/16 | 3 5/16 — 3 7/16 | .. | .. | .. |
| 40,000 | Do. "A" 6 % Cum. Pref., 1 to 40,000 | 5 | .. | 6 % | 6 % | 6 % | 5⅜ — 5⅝ | 5⅜ — 5⅝ | .. | .. | .. |
| 27,500 | Do "B" do. 1 to 27,500 .. .. | 5 | .. | 6 % | 6 % | 6 % | 5 — 5½ | 5 — 5½ | .. | .. | .. |
| 317,700 | Do. 5 % Deb. Stock .. .. .. | 100 | .. | 5 % | 5 % | 5 % | 104 —106 xd | 104 —106 | .. | .. | .. |
| 190,000 | Do. 5 % 2nd Deb. Stock .. .. | 100 | .. | 5 % | 5 % | 5 % | 101 —104 xd | 101 —101 | .. | .. | .. |
| 105,000 | Calcutta Trams., 1 to 105,000 .. .. .. | 5 | .. | 6 % | 8 % | 8 % | 8¼ — 8⅝ | 8 — 8⅜ | 8 1/16 | .. | — ⅛ |
| 32,610 | Do. 105,001 to 137,610 .. .. .. | 5 | .. | .. | .. | 8 % | 8 — 8½ xd | 7⅞ — 8¼ | .. | .. | — ⅛ |
| 850,000 | Do. 4½ % 1st Deb. Stock .. .. | 100 | .. | 4½ % | 4½ % | 4½ % | 103 —105 xd | 102 —104 | 103 | 102½ | —1 |
| 85,000 | Callender's Cable Construction shares .. .. | 5 | 15 % | 12½ % | 12½ % | 15 % | 10¼ — 11¼ | 10¼ — 11¼ | 10⅝ | .. | .. |
| 40,000 | Do. do. 5 % Cum. Pref. .. .. .. | 5 | 5 % | 5 % | 5 % | 5 % | 5⅜ — 5⅝ xd | 5⅜ — 5⅝ | 5 5/16 | .. | .. |
| 800,000 | Do. do. 4½ % 1st Mort. Deb. Stock Red. | Stock | 4½ % | 4½ % | 4½ % | 4½ % | 107 —109 xd | 107½—109½ | .. | .. | + ½ |
| 491,222 | Cape E. Trams., 1 to 491,222 .. .. .. | 1 | .. | 15 % | 10 % | 5 % | ½ — ⅝ | ½ — ⅝ | .. | .. | .. |
| 450,000 | Castner-Kellner Alkali, 1 to 450,000 .. .. | 1 | .. | 4 % | 4 % | 6 % | 1 3/32 — 1 5/32 | 1 3/32 — 1 5/32 | 22/3 | 21/3 | .. |
| 230,211 | Do. do. 4½ % 1st Mort. Deb. Stock | 100 | .. | 4½ % | 4½ % | 4½ % | 97 —102 | 97 —102 | 100½ | .. | .. |
| 1,989,698 | Central London Railway, Ord. Stock .. .. | Stock | 4 % | 4 % | 4 % | 4 % | 85 — 87 | 85 — 87 | 87 | 85 | .. |
| 530,316 | Do. do. 4 % Pref. Stock .. | Stock | 4 % | 4 % | 4 % | 4 % | 99 —101 | 99 —101 | .. | .. | .. |
| 530,316 | Do. do. Def. do. .. .. | Stock | 4 % | 4 % | 4 % | 4 % | 74 — 77 | 74 — 77 | .. | .. | .. |
| 1,480,000 | City and South London Railway .. .. .. | Stock | 3½ % | 3½ % | 2½ % | 1½ % | 39 — 41 | 41 — 43 | 42 | 40½ | +2 |
| 85,000 | Crompton & Co., Nos. 1 to 85,000 .. .. .. | 5 | 5 % | 2½ % | 2½ % | .. | 1 1/16 — 1 1/8 | 1 1/16 — 1 1/8 | .. | .. | .. |
| 400,000‡ | Do. 5 % 1st Mort. Reg. Debs., 1 to 900 of £100, and 901 to 11,000 of £50 Red. | .. | 5 % | 5 % | 5 % | 5 % | 94 — 97 xd | 94 — 97 | .. | .. | .. |

* A period of nine months. † Quotations on Liverpool Stock Exchange. ‡ Unless otherwise stated all shares are fully paid. § Interim dividends.
‖ And bonus of 10s. ¶ From Manchester Share List.

Continued on next page.

## SHARE LIST OF ELECTRICAL COMPANIES.—*(Continued).*

### ELECTRICAL RAILWAY, MANUFACTURING AND INDUSTRIAL COMPANIES.—*(continued).*

| Present Issue. | NAME. | Stock or Share. | Dividends for the last four years. 1902. | 1903. | 1904. | 1905. | Closing Quotations July 3rd. | Closing Quotations June 10th. | Business done week ended July 10th, 1906. Highest | Lowest. | Rise + or Fall— |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 260,000 | Dick, Kerr & Co., 1 to 260,000 | 1 | .. | .. | 10 % | .. | 1 3/16 — 1 7/16 | 1 11/16 — 1 13/16 | .. | .. | — 1/16 |
| 305,000 | Do. do. 6 % Cum. Pref., 1 to 305,000 | 1 | .. | 6 % | 6 % | 6 % | 1 3/16 — 1 5/16 | 1 3/16 — 1 5/16 | 24/- | 23/9 | .. |
| 294,150 | Do. do. 4½ % Deb. Stock | 100 | .. | 4½% | 4½% | 4½% | 103 —106 xd | 103 —106 | .. | .. | .. |
| 60,000 | Dublin United Trams. (1896), 1 to 60,000 | 10 | .. | 5½% | 6 % | 6 % | 13¾ — 14¾ | 13¾ — 14¾ | .. | .. | .. |
| 59,987 | Do. 6 % Pref. between 1 and 60,000 | 10 | .. | 6 % | 6 % | 6 % | 14 — 15 | 14 — 15 | .. | .. | .. |
| 800,000 | Do. 3½ % "A" Debs. | 100 | .. | 3½% | 3½% | 3½% | 95 —100 | 95 —100 | .. | .. | .. |
| 800,000 | Do. 3½ % "B" Deb. Stock | 100 | .. | 3½% | 3½% | 3½% | 95 —100 | 94 — 96 | .. | .. | —2½ |
| 99,261 | Edison & Swan Utd., "A" shrs., £8 pd., 1 to 99,261 | 5 | Nil | Nil | 2½ 5/8 | .. | 1 3/16 — 1 5/16 | 1 3/16 — 1 5/16 | 31/3 | .. | .. |
| 17,189 | Do. "A" shares, 01—017,189 | 5 | Nil | Nil | 2½ 5/8 | .. | 2½ — 3 | 2½ — 3 | .. | .. | .. |
| 844,023 | Do. 4 % Deb. Stock Red. | 100 | 4 % | 4 % | 4 % | 4 % | 85 — 87 xd | 85 — 87 | .. | .. | .. |
| 100,000 | Do. 5 % 2nd Deb. Stock Prov. Certs. all pd. | 100 | 5 % | 5 % | 5 % | 5 % | 90 — 95 | 90 — 95 | .. | .. | .. |
| 112,100 | Electric Construction 1 to 112,100 | 2 | 6 % | 4 % | Nil | .. | 3/8 — 7/16 | 3/8 — 7/16 | 9/- | .. | .. |
| 31,890 | Do. do. 7 % Cum. Pref., 1 to 31,890 | 2 | 7 % | 7 % | 7 % | .. | 2 — 2½ | 2 — 2½ | 42/6 | .. | .. |
| 200,000 | Do. do. 4 % Perp. 1st Mort. Deb. Stk. | Stock | 4 % | 4 % | 4 % | 4 % | 88 — 91 | 88 — 91 | .. | .. | .. |
| 25,000 | General Electric Co. (1900), 5 % Cum. Pref. | 10 | 5 % | 5 % | 5 % | .. | 9 — 9¼ xd | 9 — 9⅜ | .. | .. | .. |
| 200,000 | Do. do. 4 % Mort. Deb. | Stock | 4 % | 4 % | 4 % | 4 % | 93 — 97 | 93 — 97 | .. | .. | .. |
| 78,000 | Gt. N. & City Rail Pref. Ord. "A" 4 % 1 to 78,000 | 10 | .. | 3 % | 4 % | 4 % | 3¾ — 4 | 3¾ — 3⅞ | 73/1½ | .. | — ⅛ |
| 96,000 | Greenwood & Batley 7 % Cum. Pref. | 10 | .. | 7 % | 7 % | 7 % | 10¾ — 11¼ | 10¾ — 11¼ | .. | .. | .. |
| 80,000 | Do. do. 5 % Mort. Debs. | 100 | .. | 5 % | 5 % | 5 % | 100 —101 | 101 —102 | .. | .. | +1 |
| 200,000 | Henley's (W. T.), Telegraph Works, Ord. | 5 | 20 % | 15 % | 15 % | 15% | 12 — 13 | 12 — 13 | 12 7/16 | .. | .. |
| 200,000 | Do. do. 4½ % Pref. | 5 | 4½% | 4½% | 4½% | 4½% | 5¼ — 5½ | 5¼ — 5½ | .. | .. | .. |
| 41,978 | Do. do. 4½ Mort. Deb. Stock | Stock | 4½% | 4½% | 4½% | 4½% | 107 —109 | 107 —109 | 107 | .. | .. |
| 108,022 | Do. do. Scrip. All paid | .. | .. | .. | .. | .. | 107 —109 | 107 —109 | .. | .. | .. |
| 50,000 | India-Rubber, Gutta-Percha & Telegraph Works. | 10 | 10 % | 10% | 5 % | 10% | 17 — 18 xd | 17 — 18 | 17 3/32 | 17 1/16 | .. |
| 37,500 | †Liverpool Overhead Railway, Ord. | 10 | 1½% | 1½% | 1½% | Nil | 1½ — 1⅝ | 1½ — 1⅝ | .. | .. | .. |
| 10,000 | † Do. do. Pref. £10 paid | 10 | 5 % | 5 % | 5 % | 5 % | 4 — 5 | 4 — 6 | .. | .. | + ½ |
| 600,070 | London United Trams (1901), 1 to 50,007 | 10 | .. | 8 % | 6 % | 3 % | 8 — 8½ | 8 — 8½ | .. | .. | .. |
| 899,930 | Do. do. 50,008 to 100,000 (£6 paid) | 10 | .. | 8 % | 6 % | 3 % | 4 — 5 | 4 — 5 | .. | .. | .. |
| 125,000 | Do. do. 5 % Cum. Pref., 1 to 125,000 | 10 | .. | 5 % | 5 % | 5 % | 7½ — 8⅝ xd | 7¾ — 8¾ | 8⅛ | 7⅞ | .. |
| 1,331,000 | Do. do. 4 % 1st Mort. Deb. Stock | 100 | .. | 4 % | 4 % | 4 % | 94 — 97 xd | 94 — 97 | 95¾ | .. | .. |
| 314,016 | Metropolitan Electric Trams, Defd. | 1 | Nil | Nil | Nil | 3 % | 3/16 — ¼ | 3/16 — ¼ | .. | .. | .. |
| 500,000 | Do. 5 % Cum. Pref. | 1 | 5 % | 5 % | 5 % | 5 % | ⅛ — 1 | 1/16 — 1/16 | .. | .. | — 1/16 |
| 350,000 | Do. 4½ % Deb. Stock Red. | 100 | .. | .. | 4½% | 4½% | 100 —102 xd | 100 —102 | .. | .. | .. |
| 20,000 | Peebles (B.) & Co. 6 % Cum. Pref., 20,001 to 40,000 | 5 | .. | .. | 6 % | 6 % | 4⅞ — 5⅛ | 4⅞ — 5⅛ | 98/9 | .. | .. |
| 24,500 | Potteries E. Trc., 20,001 to 40,000 & 50,001 to 54,500 | 10 | .. | 5 % | 5 % | 4 % | 7 — 8 | 6¾ — 7¾ | .. | .. | — ¾ |
| 24,500 | Do. 5 % Cum. Pref., 1 to 20,000 & 40,001 to 44,500 | 10 | .. | 5 % | 5 % | 5 % | 7¾ — 8¾ | 7⅞ — 8⅞ | .. | .. | — ¼ |
| 245,000 | Do. 4½ % Deb. Stock | 100 | .. | 4½% | 4½% | 4½% | 100 —103 | 100 —103 | .. | .. | .. |
| 37,850 | Telegraph Construction and Maintenance | 12 | 20 % | 20 % | 15 % | 15 % | 32 — 34 | 32½ — 34½ | 34 | 33⅜ | + ½ |
| 150,000 | Do. 4 % Deb. Bds., 1 to 1,500 Red. 1909 | 100 | 4 % | 4 % | 4 % | 4 % | 100 —102 xd | 100 —102 | .. | .. | .. |
| 3,599,200 | Undergd. E. R., Lon., 5 % Profit Shar. S. Nts. | .. | .. | .. | 5 % | 5 % | 94 — 96 | 94 — 96 | .. | .. | .. |
| 540,000 | Waterloo & City Railway, Ord. Stock | 100 | 3½% | 3½% | 3½% | 3½% | 100 —103 | 100 —103 | .. | .. | .. |
| 66,666 | Willans & Robinson, 1 to 30,000 & 80,001 to 116,666 | 5 | 8½% | 3 % | Nil | Nil | 1¼ — 1⅝ | 1 — 1½ | .. | .. | — ⅛ |
| 66,666 | Do. 6 % C. P., 30,001 to 80,000 & 125,001 to 141,666 | 5 | .. | 6 % | Nil | Nil | 2⅜ — 3½ | 2⅜ — 3½ | .. | .. | .. |
| 246,806 | Do. 4 % 1st Mort. Deb. Stock | 100 | .. | 4 % | 4 % | 4 % | 78 — 83 | 78 — 83 | .. | .. | .. |

### ELECTRICITY SUPPLY COMPANIES.

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 14,000 | Bromley (Kent) E.L. & P., 1 to 14,000 | 5 | .. | 5 % | 5½% | 4 5/8 % | 5⅛ — 5⅜ | 5⅛ — 5⅜ | .. | .. | .. |
| 50,000 | Do. do. 4½ % 1st. deb. stock | 100 | .. | 4½% | 4½% | 4½% | 101 —104 | 101 —104 | .. | .. | .. |
| 29,377 | Brompton & Kens. Elec. Lt. Sup., Ord., 1 to 20,000 | 5 | 8 % | 10 % | 10 % | 10 % | 8 — 9 | 8 — 9 | 8¾ | .. | .. |
| 10,623 | Do. do. 7 % Cum. Pref. | 5 | 7 % | 7 % | 7 % | 7 % | 7⅞ — 8¼ | 7¾ — 8¼ | .. | .. | .. |
| 300,000 | Central Electric Supply 4 % Guar. Deb. Stock | 100 | 4 % | 4 % | 4 % | 4 % | 100 —103 | 100 —103 | .. | .. | .. |
| 80,000 | Charing Cross and Strand Electricity Supply | 5 | 10 % | 8 % | 8 % | 5 % | 4 — 5 | 4 — 5 | .. | .. | .. |
| 80,000 | Do. do. do. 4½ % Cum. Pref. | 5 | 4½% | 4½% | 4½% | 4½% | 4⅛ — 4¼ | 4 — 4⅛ | 90/- | .. | — ¼ |
| 40,000 | Do. "City Undertaking" 4½ % Cum. Prf. | 5 | 4½% | 4½% | 4½% | 4½% | 3⅞ — 4¼ xd | 3¾ — 4¼ | .. | .. | .. |
| 40,000 | Do. do. 1903 | 5 | .. | 4½% | 4½% | 4½% | 3¾ — 4¼ xd | 3¾ — 4¼ | .. | .. | .. |
| 490,000 | Do. do. 4 % Deb. Stock Red. | 100 | 4 % | 4 % | 4 % | 4 % | 99 —102 | 99 —102 | .. | .. | .. |
| 44,496 | Chelsea Electricity Supply, Ord. | 5 | 4½% | 5½% | 6 % | 6 % | 5¼ — 5⅜ | 5¼ — 5⅜ | 5 7/16 | .. | .. |
| 175,000 | Do. do. 4½ % Deb. Stock Red. | Stock | 4½% | 4½% | 4½% | 4½% | 106 —108 xd | 106 —108 | .. | .. | .. |
| 70,595 | City of London Elec. Lighting, Ord. 40,001—110,595 | 10 | 5 % | 5 % | 6 % | 6 % | 10¾ — 11¼ | 10¾ — 11¼ | 10⅜ | .. | .. |
| 40,000 | Do. 6 % Cum. Pref., 1 to 40,000 | 10 | 6 % | 6 % | 6 % | 6 % | 12 — 13 | 11⅞ — 12¾ | 12⅜ | 11⅞ | — ¼ |
| 400,000 | Do. 5 % Db. Stk., Scrip. (iss. at 115) all pd. | .. | 5 % | 5 % | 5 % | 5 % | 121 —124 xd | 121 —124 | .. | .. | .. |
| 800,000 | Do. 4½ % 2nd Db. Stk., Prov. Crts., all pd. | 100 | 4½% | 4½% | 4½% | 4½% | 99 —102 xd | 99 —102 | 100 | .. | .. |
| 40,000 | County of Durham Electrical Power, Ord. | 2 | 4 % | 4 % | £3 7 0 | 4 % | 2 1/8 — 3 3/16 | 2 1/8 — 3 3/16 | .. | .. | .. |
| 50,000 | Do. do. do. 5 % Pref. | 5 | 5 % | 5 % | 5 % | 5 % | 5 — 5½ | 5 — 5½ | .. | .. | .. |
| 40,000 | County of London Electric Lighting, Ord. 1—40,000 | 10 | 4 % | 4 % | 4½% | 5 % | 8 — 9 | 8 — 9 | 8⅜ | 8 5/16 | .. |
| 80,000 | Do. do. 6 % Pref., 40,001—60,000 | 10 | 6 % | 6 % | 6 % | 6 % | 11¼ — 12¼ | 11¼ — 12¼ | .. | .. | .. |
| 400,000 | Do. do. 4½ % Deb. Stock | .. | 4½% | 4½% | 4½% | 4½% | 107 —110 xd | 107 —110 | 107 | .. | .. |
| 400,000 | Do. do. 4½ % 2nd Deb. Stock | Stock | 4½% | 4½% | 4½% | 4½% | 101 —104 | 101 —104 | 102⅜ | .. | .. |
| 80,000 | Edmundson's Electric Corporation, Ord. Shares | 5 | 7 % | 7 % | 7 % | 5 5/8 % | 3⅜ — 4¼ | 3⅜ — 4¼ | .. | .. | .. |
| 80,000 | Do. do. 6 % Cum. Pref. | .. | 6 % | 6 % | 6 % | 6 % | 4½ — 5 | 4⅜ — 5 | 95/- | .. | .. |
| 820,000 | Do. do. 4½ % 1st Mort Deb. Stk | 100 | 4½% | 4½% | 4½% | 4½% | 103 —106 | 103 —106 | .. | .. | .. |
| 10,000 | Folkestone, 1 to 10,000 | 5 | .. | 5½% | 5½% | 5½% | 5½ — 5⅝ | 5½ — 5⅝ | 5 7/16 | .. | .. |
| 10,000 | Do. 5 % Cum. Pref., 1 to 10,000 | 5 | .. | .. | .. | 5 % | 5 — 5½ | 5 — 5½ | .. | .. | .. |
| 75,000 | Do. 4½ % 1st. Deb. Stock | 100 | .. | 4½% | 4½% | 4½% | 101 —104 | 101 —104 | .. | .. | .. |
| 13,000 | Hove, 1 to 13,000 | 5 | .. | 8½% | 8½% | 9 % | 7⅞ — 8¼ | 7⅞ — 8¼ | 8 1/16 | .. | .. |
| 10,000 | Do. New (£6 10s. paid) | £8 | .. | 8½% | 8½% | 9 % | 7 — 7⅜ | 7 — 7⅜ | .. | .. | .. |
| 87,303 | Do. 4 % Deb. Stock | 100 | .. | 4 % | 4 % | 4 % | 96 — 99 | 96 — 99 | .. | .. | .. |
| 7,300 | Do. 4½ % Deb. Stock | 100 | .. | 4½% | 4½% | 4½% | 96 — 99 | 96 — 99 | .. | .. | .. |
| 21,000 | Kensington and Knightsbridge Electric Ord. | 5 | 10 % | 12% | 12 % | 10 % | 10 — 11 | 10 — 11 | .. | .. | .. |
| 90,000 | Do. do. do. 4 % Deben. Stk. | Stock | 4 % | 4 % | 4 % | 4 % | 98 —101 | 98 —101 | .. | .. | .. |
| 111,000 | London Electric Supply Corporation, Limited, Ord. | 3 | Nil | Nil | 3 % | 4 % | 2 — 2⅛ | 2 — 2⅛ | .. | .. | .. |
| 60,000 | Do. do. do. 6 % Pref. | 5 | 6 % | 6 % | 6 % | 6 % | 5 — 5⅜ | 5 — 5⅜ | .. | .. | .. |
| 674,395 | Do. do. 4 % 1st Mort. Deb. Stk. Red. | Stock | 4 % | 4 % | 4 % | 4 % | 96 — 99 | £6 — 99 | 98 | .. | .. |
| 200,000 | Metropolitan Electric Supply, 1 to 100,000 | 5 | 7½% | 8½% | 10 % | 10 % | 8¼ — 9¼ | 8¼ — 9¼ | 8⅞ | 8¾ | .. |
| 76,121 | Do. 4½ % Cum. Pref. 1—71,106, £8 pd. | 5 | 4½% | 4½% | 4½% | 4½% | 5¼ — 5⅜ xd | 5 1/16 — 5 1/16 | 5⅜ | 5 5/16 | + 1/16 |
| 220,000 | Do. 4½ % 1st Mort. Deben. Stock | .. | 4½% | 4½% | 4½% | 4½% | 109 —113 xd | 109 —113 | .. | .. | .. |
| 250,000 | Do. 3½ % Mort. Deben. Stock Redem. | Stock | 3½% | 3½% | 3½% | 3½% | 94 — 96 xd | 94 — 96 | .. | .. | .. |
| 250,000 | Midland Electric Corporation, 4½ % 1st Mort. Deb. | 100 | 4½% | 4½% | 4½% | 4½% | 98 —101 xd | 98 —101 | 101 | .. | .. |
| 75,000 | Newcastle-on-Tyne, 1 to 75,000 | 5 | .. | 8 % | 8 % | 8 % | 7⅜ — 8⅛ | 7⅜ — 8⅛ | .. | .. | .. |
| 75,000 | Do. 5 % Pref., 1 to 75,000 | 5 | .. | 5% | 5 % | 5 % | 5⅜ — 6¼ | 5⅜ — 6¼ | .. | .. | .. |
| 10,852 | Notting Hill Electric Lighting | 10 | 6 % | 6 % | 7 % | 7½% | 13½ — 14½ xd | 13½ — 14½ | .. | .. | .. |
| 64,000 | Do. do. 4 % 1st Mort. Deb. | 100 | 4 % | 4 % | 4 % | 4 % | 97 — 99 | 97 — 99 | .. | .. | .. |
| 18,500 | Oxford, 1 to 96 and 407 to 18,810 | 5 | .. | 6½% | 7 % | 7 % | 6⅝ — 6⅞ | 6⅝ — 6⅞ | .. | .. | .. |
| 50,000 | Do. 4 % Deb. Stock | 100 | .. | 4 % | 4 % | 4 % | 99 —101 | 99 —101 | .. | .. | .. |
| 40,000 | St. James' and Pall Mall Electric Light, Ord. | 5 | 14½% | 14½% | 14½% | 12½% | 10¾ — 11¼ | 10¾ — 11¼ | .. | .. | .. |
| 20,000 | Do. do. 7 % Pref. 20,081 to 40,080 | 5 | 7 % | 7 % | 7 % | 7 % | 7 — 8 | 7 — 8 | .. | .. | .. |
| 150,000 | Do. do. 3½ % Deb. Stock Red. | 100 | 3½% | 3½% | 3½% | 3½% | 95 — 97 xd | 95 — 97 | .. | .. | .. |
| 12,000 | Smithfield Markets Electric Supply, Ord. | 5 | 2½% | 4 % | 4 % | 4 % | 2 — 2⅜ | 2 — 2⅜ | .. | .. | .. |
| 60,000 | Do. do. do. 4 % Deb. Stock | Stock | 4 % | 4 % | 4 % | 4 % | 76 — 80 | 76 — 80 | .. | .. | .. |
| 65,000 | South London Electricity Supply, Ord. | 5 | 12½% | 8 % | 4 % | 4 % | 2⅜ — 3⅛ | 2⅜ — 3⅛ | 57/6 | .. | .. |
| 103,700 | South Met. Elec. Lt. & Power (Ord. | 1 | Nil | Nil | Nil | 2½% | 3/16 — ¼ | 3/16 — ¼ | .. | .. | .. |
| 85,368 | *(Late Blackheath and Greenwich* 7 % Pref. | 1 | Nil | 7 % | 7 % | 7 % | 1 1/16 — 1 1/16 | 1 1/16 — 1 1/16 | .. | .. | .. |
| 148,292 | *Dist. E.L.Co.)* 4½ % 1st Deb. Stk. | 100 | 4½% | 4½% | 4½% | 4½% | 103 —106 | 103 —106 | .. | .. | .. |
| 50,000 | Urban Electric Supply, Ord. | 5 | 5 % | 5 % | 5 % | 5 % | 3½ — 3⅝ | 3⅝ — 3⅞ | .. | .. | + ⅛ |
| 80,000 | Do. do. 5 % Cum. Pref. | 5 | 5 % | 5 % | 5 % | 5 % | 4½ — 5 | 4½ — 5 | 95/- | .. | .. |
| 200,000 | Do. do. 4½ % 1st Mort. Db. Stk. Red | 100 | .. | .. | 4½% | 4½% | 100 —102 | 100 —102 | 101¼ | 101 | .. |
| 110,000 | Westminster Electric Supply, Ord. | 5 | 12 % | 13½% | 14 % | 18 % | 10¾ — 11¼ | 10¾ — 11¼ | .. | .. | .. |
| 28,151 | Do do. 4½ % Cum. Pref. (Originally 5 %—Red. to 4½ % from 31st Dec., 1905.) | 5 | 5 % | 5 % | 5 % | 5 % | 5¼ — 5½ xd | 5¼ — 5½ | 5 7/16 | 5 5/16 | .. |

Shares not officially quoted :—Mackay Companies, ord., 74—76. Pref. 74—76.
† Unless otherwise stated all shares are fully paid. § Interim dividends.

(Bank rate of discount 3½ per cent. June 21st, 1906).

## REVIEWS.

*Transactions of the International Electrical Congress, St. Louis*, 1904. Published under the care of the General Secretary and Treasurer, New York, 1905.

(*Concluded from Vol.* 58, *page* 928.)

The second volume has for frontispiece a view of Group F, consisting almost entirely of members of the American Institute and the British Institution of Electrical Engineers. It contains the transactions of Section C, Electro-chemistry; Section D, Electric Power Transmission; and Section E, Electric Light and Distribution.

In Section C, Mr. J. S. Edstrom's paper on the electrical extraction of nitrogen from the air was one of the most important, dealing mainly with the process of Birkeland and Eyde. Mr. J. Swinburne explained his process for treating sulphide ores with chlorine, and a valuable paper was contributed by Dr. K. E. Guthe on the silver voltameter. A number of other papers related to standard cells, electrolysis, &c.

In Section D, the papers dealt mainly with high pressure lines, and several of them were very short, but full of interest, and the discussions were no less informative. One of the most important papers was that of Prof. F. G. Baum on high pressure long-distance transmission, wherein he described the methods and apparatus used in dealing with pressures up to 60,000 volts, and networks in California including 700 miles of line at 50,000 volts, to say nothing of 70 miles at 40,000 volts—figures which we on this side can hardly realise. The author considered that 100,000 volts would be attained within a few years. Dr. Perrine contributed a valuable paper on the same subject, and the use of copper, steel and aluminium wire, as well as glass and porcelain for insulators, and wood *v.* steel poles for overhead lines, was fully treated by various authorities. It appears that wooden pins and glass insulators are unsuitable for use near salt water; dirt on the insulators gives little trouble, and rain is actually an unmitigated blessing. Long spans and steel supports are recommended. Mr. R. D. Mershon investigated the maximum distance to which power could be economically transmitted, and found it to be in the neighbourhood of 550 miles, assuming a load of a quarter of a million kilowatts.

Section E opened with a paper by Mr. Arthur Wright on electrolytic meters, followed by one on tariffs by M. Etienne de Fodor, in which reduction in the price of electrical energy was strongly advocated. As the rates charged for electric lighting in 50 European towns average about 7½d. per unit, the author had good reason for his contention: it was unfortunate that his list did not include any British towns—in so many of which the price is less than half this value. The subjects dealt with in other papers covered a wide and varied range; Mr. Alex. Dow discussed systems of distribution in American cities, and argued strongly against high-voltage lamps, while Dr. G. Stern upheld alternating-current against direct-current supply, both propositions being directly contrary to British conclusions. This fact was pressed home by Col. Crompton and Mr. Robert Hammond, in the course of an unusually animated discussion. Important papers were read on the arc by Mr. C. P. Steinmetz and Prof. A. Blondel, and Col. Crompton described the work of the Engineering Standards Committee on dynamo-electric machinery; other papers dealt with light standards, steam turbines, meters, &c., and, lastly, Mr. H. F. Parshall briefly described the Yorkshire and Lancashire power supply undertakings, as illustrations of the conditions affecting this industry in England.

Vol. III opens with an excellent view of the electricity building at the St. Louis Exposition, and contains the record of the transactions of Section F, Electric Transportation; Section G, Electric Communication; and Section H, Electro-therapeutics; closing with the Roll of Members of the International Electrical Congress. In Section F the first paper was one by Mr. Philip Dawson, and therefore related to "Electric Traction on British Railways"; the author advocated the judicious adoption of electric traction, beginning with suburban and short interurban lines, and contended that overhead conductors at high pressure were essential features of sound and safe construction. He mentioned that there were over 228 route miles of railway, with 273 stations, within the County of London. In the discussion, Mr. Sprague expressed doubt whether electric traction was justified for use where high-powered units were sent long distances at long intervals, and commented on the conservative methods of English railways, which he ascribed largely to the advanced age of the average director. Mr. J. B. Entz dealt with storage batteries in electric railway service, emphasising their value, and Mr. B. J. Arnold described his electro-pneumatic system of single-phase traction.

Alternating-current motors were very fully dealt with in mathematical papers by Messrs. C. P. Steinmetz, Max Deri, M. Latour, O. S. Bragstad, and E. Danielson, and some single-phase railway problems were discussed by Mr. P. M. Lincoln. An important paper on A.C. *v.* D.C. traction was contributed by Prof. Dr. F. Niethammer, giving many valuable data and particulars of actual designs and results. The author referred to the advantages of shunt motors for some cases, especially mountain lines, where they are preferable to three-phase motors. The paper formed a useful epitome of the general problem of electric railway traction. Mr. B. J. Arnold dealt with the electrification of steam railroads, and the discussion on the last two papers was exceptionally full. Mr. F. B. Behr described his mono-rail railway, and Prof. Dr. G. Rasch discussed the "buffer booster" for traction, an old idea of Mr. Kapp's revived and developed—namely, a motor driving a heavy fly-wheel, and acting in much the same way as a storage battery. Mr Frank J. Sprague contributed an historical paper on electric railways, and Mr. L. B. Stillwell described the equipment of one. Lastly, Mr. R. A. Parke discussed the braking of high-speed trains.

In Section G, Mr. Saitaro Oi gave an exceedingly interesting account of the remarkable progress made in telegraphy and telephony in Japan, and Dr. A. E. Kennelly described a research on high frequency telephone circuit tests. Mr. J. Hesketh, electrical engineer for the State of Queensland, described perforations in lead-covered aerial telephone cables due to the Eceloneurus beetle; as many as 14 holes have been found in a length of 16 in. of cable, and sometimes hundreds of holes in a single cable. Passing over many papers, we must mention one on the wireless telegraph system of the Italian Government, by Marquis L. Solari, which also dealt largely with the work of Mr. Marconi; other papers on wireless telegraphy were contributed by Dr. Lee de Forest and Prof. J. A. Fleming, and the subjects of telephony, electrolysis of underground conductors, &c., were also dealt with at considerable length.

In Section H a large number of papers were read, mainly of therapeutic interest, but including such matters as the electrical purification of drinking water, improvements in apparatus, &c.

Taking the volumes as a whole, we can only repeat that they form a comprehensive treatise of not merely ephemeral value, but of permanent interest and usefulness, which constitutes a remarkable summary of the state of electrical knowledge at the date of the Congress, and is a fitting souvenir of the proceedings at that landmark in the history of the science. All who contributed to the work are entitled to congratulation, not forgetting the able editors and the printers.

## PROCEEDINGS OF INSTITUTIONS.

### A New Single-phase Commutator Motor.

By V. A. FYNN, M.I.E.E.

(*Abstract of Discussion* on Paper read before the* INSTITUTION OF ELECTRICAL ENGINEERS, *March 8th*, 1906.)

THE author extended the theory discussed in his paper, and concluded:—I should like to add a few words about sparking. I have shown in my paper that the reactance voltage only need be con-

* The figure numbers herein quoted correspond with those used in the abstract of the paper published in our issues of May 18th and 25th, 1906.—EDS.

sidered under the normal running conditions of this motor. We may take it that, just as in the continuous-current machine, this voltage is in phase with the armature current, and can therefore be counteracted by the same means—*i.e.*, by the use of commutating poles. To be absolutely effective under all loads, these poles ought to carry windings disposed in series relation to the rotor currents, the commutation of which they are to assist. This would be inconvenient for many reasons, and in practice sufficiently good results are obtained by making use of the corresponding stator current (I). Commutating poles excited in this manner will not induce E.M.F.'s absolutely in phase with the reactance voltage, but this disparity of phase will decrease with increasing load, and it is at the heavier loads that their help is mostly needed. No kind of commutating coils will, however, help to reduce any tendency to spark at the moment of starting, and at that particular stage nothing but a heavy armature current, weak motor field, and resistances between commutator segments and rotor winding will be of the slightest use. Now, the use of resistances between commutator and rotor winding is detrimental to the efficiency of these motors once they have attained their normal speed. We have, however, ready means at hand for reducing this harmful influence to a negligible quantity by making use of the auxiliary revolving short-circuits indicated in figs. 11 and 12. It is therefore quite easy to construct this particular motor for very large sizes, being able at the same time to guarantee perfect commutation. In this respect, as in the many others already enumerated, it presents great advantages over other types of alternating-current motors.

Mr. LLEWELYN B. ATKINSON: I think, in addition to congratulating the author on the paper he has given us, we have to congratulate the electrical world on the results which he has obtained. The author has been working at this subject steadily for the last eight or ten years, and he has succeeded in bringing to a triumph the motor which he has put before us in this paper to-night. The author has alluded to my own work on this subject, and especially to a paper which I read in 1898 on this very question before the Institution of Civil Engineers. At that time practically all explanations and theories connected with alternating motors rested on a discussion of a rotary field, which, I think, did a very great deal to retard the progress of design in electrical motors of the alternating-current type. As long ago as 1888 I took out my first patent on alternating-current motors, based on the idea of a transformer with a rotating secondary coil, and with a magnetic field acting upon the wires carrying currents induced in that secondary coil. A small machine of that kind was built. Among the men in this country whom I was able to interest were Mr. Edward Cowan and Mr. E. Still, who worked a good deal with me in experimental work on this motor, and with me built in 1896-7 a series induction motor with short-circuited brushes. The maximum power which we obtained was 4½ H.P., ranging from ·69. With 4½ H.P. the efficiency was low, about 65 per cent., and the power-factor was also low, about 57 to 70 per cent. The current in the armature was not greater at starting than it was when running. That was a state of affairs that had not been reached with any of the squirrel-cage single-phase motors. We had a great deal of trouble with sparking, but we got fairly good results. Patents were taken out in England for this motor, but when we came to Germany we were met with the statement that everything was known, and only very limited patents were granted. With regard to America, I carried on a struggle with the examiners for two years. The author, by an exceedingly clever design, has succeeded in getting over the sparking difficulty, and in so proportioning his parts that he has got fairly good efficiencies. But he has done more; he has succeeded in solving, in a remarkable way, the combination of a compensated motor—that is to say, one in which the power factor is brought to unity without condensers or other outside appliances, in a motor giving an exceedingly good torque at starting and a good efficiency. I consider that is not only extremely ingenious, but a stroke of genius on the part of the author, who has shown in the whole design of this motor designing power, to my mind, of the very first order. I desire to state that I know the author's investigations have not arisen out of mine, and, therefore, he may claim the entire credit of the invention to himself. The paper will have a profound bearing on many questions of power distribution, and on none with a greater effect than on tramways and the big railway electrifications which are now coming before us.

Mr. W. M. MORDEY: I happened to be in Switzerland recently and saw some of Mr. Fynn's motors in the works of Messrs. Alioth, who were good enough to arrange that I should make some tests. I was very pleased with what I saw. I will give in the *Journal** the figures I got in a rather hasty test of a 6-H.P. motor, which was run from no load up to nearly 12 H.P. Through its normal range of load its speed dropped only 100 revolutions. There was no movement of the brushes, and there was no attention to the machine at all. The power factor was nearly unity, falling a little at 100 per cent. overload. The collection was good—at the overload, I think, not worse than a direct-current motor overloaded to that extent. The starting torque I did not test. I was told the full load starting torque was obtained at about full-load current. The efficiency was low, about ·67 at full load. I doubt whether the commercial direct-current 6-H.P. motor has over ·75 efficiency. We should remember that by being able to use alternate currents we can usually get our energy to the motor with less loss than with direct current. None of the ordinary induction motors that are being sold in this country, either for one, two or three phases, have as high an efficiency as they ought to have. In these days of very high magnetic densities, when people work up to 20,000 B and more, we ought to do what we can to reduce the iron losses, by keeping our densities low, and by using thinner iron. People have made a stand against using any iron less than about No. 28—that is, about ·014 in. thick. It is quite practicable to go down, for example, to ·01. Even after allowing for the greater space taken by insulation, it will be found that the use of such iron effects an appreciable economy of energy.

Mr. F. CREEDY: I have been working for practically a twelve-month in company with the Rhodes Electrical Manufacturing Co. upon the production of a satisfactory constant-speed single-phase commutator motor; we have encountered precisely the same difficulties as Mr. Fynn, and have sought relief in very nearly the same way. For the past 10 or 11 months we have been employing motors of the type shown in fig. 5 for lift work, converting them when running into induction motors by means of slip rings in the usual way. We have not found it necessary to use a variable number of turns on the field coil $s_3$, as one does not want several stops in the controller, and it is amply sufficient to design the field and transformer coils to give the specified torque while taking not more than the specified current. The controller is still further simplified if the field and transformer coils are left in series while running as well as while starting. This produces no ill effect, as it only shifts the transformer field through the angle $a$. I think Mr. Fynn's figures for the starting torque represent very well the results we have been obtaining, erring if anything on the side of moderation, with the coils S proportioned for full-load running in series with $s_2$. With special designs, however, it is possible to get twice full-load torque with less than full-load current: or three, four, or five times full-load torque with 2 to 2½ times full-load current. I see no reason whatever why Mr. Fynn's series motor, fig. 22, should have a torque greatly in excess of that obtainable by a proper design of fig. 5. In fig. 22 the field winding is on the rotor, and there is no leakage between the field and the armature circuit. This is the obvious cause of the improved torque obtained with motor No. 3, which naturally, as an eight-pole 6-H.P. machine, will have a high leakage factor. In designing a suitable compensating arrangement for small motors, it is undesirable to use a complicated stator winding requiring a complicated controller; and on account of the small diameter of the commutator, one cannot have the brushes at small angular distances apart. This necessitates the use of a wave winding. In small motors one need not use more than two brushes per rotor circuit. For these reasons an arrangement of five equally spaced brushes on the commutator was adopted. Now, five brushes at 72° have the unique property of being equally adaptable for two, four, six or eight poles, as can easily be seen on working out the spacing. Such a compensated motor can be started in one or the other direction by joining brush A to one of the opposite brushes C or D, the other two brushes B and E being open-circuited. When up to speed, B and E are joined to two of three tappings on the stator coil, producing a suitable E.M.F. for compensating, while A is joined to the remaining brush D or C. In practice these changes of connections are effected by a double-pole two-way switch and a three-bladed centrifugal switch, practically the same controller being required as for the uncompensated motor with slip-rings. The results obtained with these motors are very similar to those of Mr. Fynn. No difficulty occurs with the commutation of these machines, at any rate, up to 20 H.P. We have used single-turn bar windings of the two-circuit type throughout, except in the smallest sizes, even up to 20 H.P., 100 cycles. This applies to a motor with slip-rings. We have as yet no experience of 20-H.P. 100-cycle motors without slip-rings, but do not anticipate any difficulty, as the starting period is the most critical, and a motor which will start up and accelerate under load sparklessly, as the slip-ring motor does, will usually run sparklessly at full load. It has been our experience that such unmechanical devices as high-resistance commutator connections are quite unnecessary in any properly proportioned rotor. In small machines, such as those whose tests Mr. Fynn describes, one may take extraordinary liberties with the commutation. I have myself succeeded in getting good commutation on a 1·5-H.P. four-pole 50-cycle machine, having no less than six turns per commutator section, though I do not recommend the practice. I have even used copper gauze brushes on several small machines of about this size.

Mr. C. F. JENKIN: The author has given us a motor which has a larger output, a higher efficiency, a better power factor, and less sparking than has been obtained before. This is a very great achievement. The motor, as a repulsion motor, has all the defects of a repulsion motor at starting. Those defects are common to all commutator motors; they are due to the transformer effect producing a current in the short-circuited coils. They are not serious, but they must not be forgotten. At the end of the paper the author makes a sudden complete rearrangement of his connections, the result being to get a compensated repulsion motor. It is the

* TEST OF 6-H.P. FYNN 50 ~ 4-POLE MOTOR AT THE WORKS OF MESSRS. ALIOTH, BASLE, JANUARY 12TH, 1906.

| B.H.P. | Revs. | Amps. | Volts. | V. × A. | Watts. | P. F. | Effic. | Amps. (a) | Volts. (v) | Collection. |
|---|---|---|---|---|---|---|---|---|---|---|
| — | 1,528 | 18·7 | 140 | 2,618 | 2,450 | ·94 | — | — | — | Fair |
| 6·3 | 1,428 | 53 | 139·5 | 7,393·5 | 7,050 | ·95 | ·67 | 125 | 11 | Good |
| 7·5 | 1,408 | 59 | 140 | 8,260 | 8,000 | ·97 | ·7 | 120 | 11 | ,, |
| 8·7 | 1,355 | 71·5 | 140·5 | 10,046 | 9,500 | ·95 | ·68 | 117 | — | Fair |
| 9·8 | 1,310 | 81·5 | 139·7 | 11,385 | 10,750 | ·95 | ·68 | 115 | — | Bad |
| 11·8 | 1,220 | 120 | 140 | 16,800 | 15,000 | ·89 | ·58 | — | — | Worse |

*Remarks.*—Fixed brushes throughout. No adjustment of any kind. Load was a water-cooled friction brake on pulley with adjustable weights.

(a) and (v) were current + (brush) volts in short-circuit at circuit "A" in diagram.

ordinary Latour or Winter-Eichberg motor; it is a special arrangement without a transformer. In this connection I may point out that Mr. Eichberg, in a paper published in January, 1904, has shown a connection of his compensated repulsion motor which will make it work as a constant-speed or shunt motor. It is difficult to compare the two without making actual calculations of the losses, but I am inclined to think that Mr. Fynn's motor will be better than Eichberg's motor.

Mr. H. M. HOBART: Mr. Mordey has spoken of a 6-H.P. motor which he tested at Basle which had 67 per cent. efficiency—that means 33 per cent. loss. The ordinary 6-H.P. polyphase or continuous-current motor would have something like 84 per cent. efficiency, or 16 per cent. loss—that is to say, the comparative loss is, in the single-phase motor, something like double. Therefore, if the means of ventilation and temperature rise permitted are just about the same in both designs, the single-phase motor must necessarily have something like twice the weight of the motor with the lower loss, whether it be continuous current or polyphase. A motor of twice the weight would probably cost at least 50 per cent. more, and so until great improvements are effected we must make up our minds to pay something like one and a half times as much for a single-phase motor of a given output and speed as for a continuous-current or polyphase motor of the same output and speed. But we shall also have to put up with a less economy due to the lower efficiency. If higher efficiencies can be obtained, well and good; that will remove this difficulty. It is not at first obvious that great weight should be a fault in a motor. For stationary motors that would not, at first sight, seem to be of great importance; but from what I have said it is evident that great weight is closely associated with low efficiency. Two points on which I should like further information are, first, the weights of some of the motors which Mr. Fynn has decribed in his paper, exclusive of slide rails and pulley, and the corresponding ratios of these weights to the combined weight of copper and sheet iron—*i.e.*, of so-called "active" material. It would be of especial interest also if Mr. Fynn would give the weight of the 6-H.P. motor to which Mr. Mordey referred, and its rated speed, periodicity, and voltage. The standard thermometrically determined temperature-rise above surrounding air should be given, and this should correspond to the hottest accessible part when the motor is operated continuously at its rated load.

Mr. T. L. LA COUR (communicated): It is shown in figs. 10, 11 and 12 of the paper that a new winding for compensated induction motors is introduced. This winding was tried by me in 1902, but I abandoned it afterwards, since it would not give satisfactory results as regards compensating. I believe that this was due to the fact that the magnetising effects of the currents in the three legs of the star and those of the mesh-(continuous-current winding) partly neutralise each other. It is stated that a commutator motor as shown in fig. 1 has all the characteristics of the asynchronous single-phase squirrel-cage motor. From my experience with this class of work and with similar polyphase motors, however, I find a considerable difference between their behaviour and that of an ordinary induction motor. Commutator motors behave more as unexcited synchronous motors, and the current diagram is distantly situated from the origin. Such motors generally hum and vibrate badly, so that it is hardly possible to run them for any length of time. This difference in behaviour from that of the ordinary

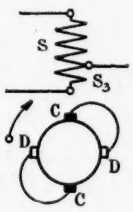


FIG. A.

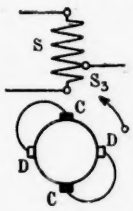


FIG. B.

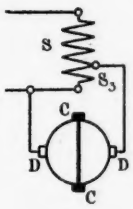


FIG. C.

induction motors is due to the fact that the reactance of the rotor winding is far from zero when the rotor runs at synchronous speed. This is experimentally verified by exhaustive tests carried out by the writer. In the paper it is further stated that motors connected as shown in figs. 22 and 23 give very good results as regards starting and speed regulation. This I have also found to be the case, and I took out patents (May 24th and November 21st, 1904) on the use of an auxiliary winding ($s_3$ in the above figures) for starting and speed regulation of compensated single-phase motors. The first experiments with such motors were carried out in June, 1904.

Mr. V. A. FYNN: In reply to Mr. Hobart, the motors, particulars of which I have given in my paper, are rated for a maximum temperature rise not exceeding 50° C. The net weights are 200 lb. for motor No. 1, 265 lb. for motor No. 2, and 660 lb. for the 83-cycle No. 3 motor. In my paper I have stated that the addition of the improvements described by me raises the output of an ordinary single-phase shunt induction motor by 30 to 40 per cent.; I add that the addition of these improvements also raises the weight of the motor at most by some 15 per cent. I trust very shortly to be in a position to publish full particulars of a new series of these motors. I cannot agree with Mr. Hobart that the efficiency of an ordinary commercial continuous-current motor of 6 B.H.P. is anything like 84 per cent.; it is much nearer 75 per cent., so that the comparative loss, even in the motor tested by Mr. Mordey, is only 32 per cent. greater than that of a continuous-current machine of the same size, and not 100 per cent., as suggested by Mr. Hobart. I have made some 60-B.H.P. motors with an efficiency of 86 per cent. at full load, and this question of efficiency is at the present moment receiving my most earnest attention. I admit that I cannot hope to equal the efficiency of a corresponding continuous current motor, mainly on account of the increased losses due to the alternating field permeating the whole frame of these single-phase motors (in most cases there are even two such fields), but I see no reason why such motors should lag by more than 5 per cent. behind continuous current machines. Their weight efficiency will, I fear, also remain behind that of their continuous current rivals, but all these differences will shortly be very much smaller than is now the case. When comparing a continuous with a single-phase commutator motor, it must never be forgotten that the former is in the prime of life, whereas the latter is only just out of the nursery. In a great many cases the use of the continuous current motor, even with its present acknowledged advantages, is quite out of the question, whereas the use of a single-phase motor of the type I have described offers a most satisfactory solution. The existence of such a machine does not sound the death-knell of any other type, but simply opens out fresh fields for the application of electrical energy. Mr. Jenkin persists in referring to a series induction motor as a "repulsion" motor; the motor I have described has nothing in common with a true repulsion motor. The motor shown in figs. 22 and 23 is much more than a Winter-Eichberg machine. The only common feature is the means for improving the power factor when running as a series induction machine. The winding $s_3$ is a most important addition; not only does this additional field winding enable the current taken by the motor on switching-in to be reduced to any desired extent, but it enables its speed to be regulated within the widest range without the use of any auxiliary transformers or the like. The price is thus greatly reduced. Under otherwise equal conditions such a motor will, with a constant line pressure, start with a greater torque than could be obtained with a motor such, for instance, as shown in fig. 13, because in figs. 22 and 23 the winding $s_3$ raises the voltage applied to the motor, and it is well known that the torque increases with the square of the voltage applied. The motor shown by Dr. Eichberg, to which Mr. Jenkin refers, is really a compensated shunt induction motor such as I have described in my paper, and which I had discovered and protected as far back as 1902. But it is worthy of note that Dr. Eichberg, in 1904, failed to recognise the real reason for the satisfactory operation of this motor as a shunt machine. Dr. Eichberg derives the auxiliary or compensating E.M.F. from a transformer independent of the motor itself, whereas I consider it distinctly more economical to derive this E.M.F. from the motor itself. There is, of course, no difference of principle involved, and I have in my patents mentioned all these variations. I cannot agree with Mr. Creedy when he says that it is not necessary to sub-divide the $s_2$ winding in fig. 5. My experience is that a motor which is designed to stand an overload of some 50 per cent. —as it ought to—will at starting take about twice its normal current if switched directly on to the mains. If Mr. Creedy's motors take less when treated in that way, it is because their overload capacity is less, or because he uses resistances in the brush circuit, for he says that he does not switch part of the winding out after the motor has started. A current twice the normal on switching-in is much too high. Then again, if he follows the same rule and tries to design his motor to develop, say, one-half normal torque and not take more than the necessary current when doing so, he will find that unless he switches part of the stator winding out after the motor has started he will not even get full load out of the machine. It is such considerations as these which lead me to the design I advocate. Of course, if Mr. Creedy converts a motor started as in fig. 5 into a shunt induction motor by short-circuiting the rotor by means of slip-rings, then I agree that, apart from the power of the motor, nothing will be altered whether he leaves $s_2$ in or not. My contention was clearly stated to the effect that $s_2$ when left in had a detrimental effect in "shunt induction motors having their rotors short-circuited along two perpendicular axes," and I referred to figs. 3 and 4, which show no revolving short-circuits as used by Mr. Creedy. My shunt motor and Dr. Eichberg's series motor both labour under one great disadvantage; the rotor in both machines has to carry not only the armature, but also the field current. Those who have designed continuous-current traction motors know that it is quite difficult enough under such conditions to get sufficient copper into the continuous-current armature, although the power factor in such machines is always unity, and their efficiency is admittedly higher. This problem, therefore, becomes much more difficult in the case of the alternate-current motor, in which the rotor copper has to convey not only the armature, but also the field current. Of course, the ordinary series induction motor shown in my fig. 5 only carries armature current in the rotor, but then its power factor is bad. I trust shortly to be able to give full particulars of a motor combining the advantages of both types. I do not quite see Mr. Creedy's point about spacing the brushes on the commutator when read in conjunction with his very correct statement that complications are undesirable. I never use more than *four* sets of brushes on my commutators, and I fancy that surely is simpler than *five* sets. For all motors with an uneven number of pole-pairs, the four sets can remain at 90°. If Mr. Creedy prefers to switch his motors on to the circuit without regard for the station engineer or the neighbouring light consumer, I can suggest a still simpler diagram of connections than his. The figs. A, B, C explain themselves; the two first show the starting, and the third, fig. C, the running connections. I do not suppose that Mr. Creedy believes he is introducing an innovation by deriving the compensating E.M.F.

from an auto-transformer instead of a transformer with separate primary and secondary winding. There is, of course, no saving or any other advantage whatsoever in his arrangement, for the simple reason that the exciting current of such motors is always many times greater than the stator current, and therefore that part of the stator winding which is tapped to obtain the auxiliary E.M.F. must be either overloaded to the point of running the risk of burning it out, or it must consist of heavier wire. There can be no doubt that it is simpler to use a separate winding, as I do, and to make it of a section suitable for the duty it has to perform. I am not surprised that the results Mr. Creedy obtains are similar to mine; he obtains them on the same motor. It is, as I have pointed out in my paper, quite immaterial along how many stationary axes you short-circuit such a motor, it still remains a shunt induction machine, and if you introduce the auxiliary E.M.F. by means of brushes midway between the short-circuited brushes, you improve the power factor in exactly the same way as has been described by me. The arrangement I use is merely the simplest and most effective of a great number of possible variations which do not depart from the spirit of the main idea. I wish it to be well understood that, although I only read my paper in 1906, the motor therein described dates back to 1902. As to resistances between rotor winding and commutator segments, Mr. Creedy himself admits that he has no experience with such motors above 20 B.H.P. Let him try to build high-power slow-speed motors such as the 60-B.H.P. motor I have referred to, and then see what he can do in the way of avoiding sparking at high frequencies and without the use of resistances. It seems that Mr. La Cour has had most unfortunate experiences with these motors. The winding he refers to has also been patented by me, and also in 1902; I have succeeded in obtaining very good results with it, and am satisfied that the patents are worth the money expended on them. The motors Mr. La Cour has experimented with must have been of a very poor design, for it certainly cannot be said that these motors suffer in any way from the disabilities mentioned by him. My motors run for any length of time as smoothly as ordinary induction motors, and this can be borne out by a great number of users.

## THE INCORPORATED MUNICIPAL ELECTRICAL ASSOCIATION.

### Relative Economies of Electrical Supply from Small Local Stations, and from Power Companies.

*(Abstract of Paper read by* JOHN F. C. SNELL, *Chief Electrical Engineer, Sunderland.)*

THE advent and development of power companies has altered materially the position of the supply of electricity. Thus it is desirable to investigate fairly the position of small boroughs and urban districts with respect to a supply of electricity.

The question is wholly one of economy; that there are some districts already supplied by gas, and in which there is no scope for electricity, may be granted.

There is, therefore, this problem: at what cost can a small district install and work its own plant on the one hand; and on the other, on what terms can a power company supply energy to such a district? The author proposes to deal with this by taking an example of a small borough, first calculating the cost of installation of, and production from, local plant; then stating broadly the cost at which a power company could reliably and safely supply from a distance, the local district council supplying the requisite transforming sub-station and low-tension distributors.

The paper deals first with the cost of generation only, since the distribution is common to both sources of supply. For example, the author knows a small borough of 3,400 inhabitants, situated on a broad and navigable river, and where land for the local generating station could be procured at a low cost beside the river, and with every facility for sea-borne coal, and for circulating water for condensing. Sea-borne Welsh coal is about 12s. 6d. per ton delivered. The rateable value of the borough is £10,000 in round figures; the area, 170 acres, and there are 5 miles of roadway and streets.

A gas company now provides the supply for lighting at a cost of 4s. 3d. per 1,000 cb. ft., and 3s. 6d. for cooking and heating; it has an annual output in cb. ft. of gas of 5,000,000. There are 750 houses within the borough. The Corporation now pays the company £300 annually for street lighting. If the author shows that electricity can be commercially sold in such a district, then *a fortiori*, it can be better provided in an inland district where the same facilities for cheap coal, &c., are not available.

What scope would there be for electricity? Suppose the Corporation to consider taking this matter up. There is the street lighting; 125 street lamps, each consuming 60 watts (say, each column having two "Tantalum" lamps) would compare most favourably with the present lighting. With a cheap method of wiring—referred to later on—the local shops, residences, churches, and other public buildings, would represent an equivalent of 7,500 32-watt lamps installed. Then there are a few tradesmen who would require a small supply of power, for stable machinery, hoists, printing, saws, laundry work, and small machines for butchers, bakers and grocers. Such is the general list of small users of power. The annual output would be somewhat of this nature:—

STREET LIGHTING.

| | | |
|---|---|---|
| 125 lamps × 60 watts × 4,380 hours per annum | | 32,850 units |

PRIVATE LIGHTING.

| | | |
|---|---|---|
| 7,500 lamps × 13 units per annum each | ... | 97,500 „ |
| Small users of power as given above, say | ... | 100,000 „ |
| Total ... ... | ... | 230,350 units sold. |

representing 70 units per inhabitant.

Such an installation would probably have a load factor (units sold) of 16 per cent.; the maximum demand on the plant would, therefore, be 165 KW.; or allowing for distribution losses, the station would have a maximum demand at the switchboard of practically 200 KW., and would require to generate some 270,000 units.

The plant installed, therefore (with a reasonable battery) would be, say, two 125-KW. steam sets, and including land and buildings, boilers, piping, steam dynamos, battery, switchboards, &c., would cost about £7,000. If suction-producer gas plant were installed in place of steam sets the cost would be practically the same figure.

The cost of production would be about 1·25d. per unit generated without capital charges, or 1·86d. per unit generated, including capital charges, or 2·2d. per unit sold, but without any charges for mains, distribution, meters or services. This, then, is the cost of production from the small local plant.

Now, consider a power company situate within, say, 7 miles of this borough. Would it pay the power company to supply, and the borough to take, electricity from this source?

Firstly, the borough must provide a sub-station with the necessary converting plant and battery, if the supply is to be direct-current. On the same output as above this sub-station would require the following plant, and would cost as follows:—

| | | |
|---|---|---|
| Land and buildings ... ... ... ... | | £4,150, or £16·6 per KW. |
| Two 125-KW. motor-generators ... ... | | |
| Battery and booster ... ... ... ... | | |
| Switchboards, &c. ... ... ... ... | | |

thus saving about £3,000 in capital outlay. The annual capital charges on this would be £270.

The local charges at the sub-station would, therefore, be somewhat as follows:—

| | |
|---|---|
| Wages at sub-stations ... | £260 |
| Capital charges ... ... | 270 |
| £530 or 0·55d. per unit generated, | |

thus leaving 1·86d.-0·55d. or 1·31d. per unit generated at the sub-station for the power company to compete on equal terms.

The average efficiency of conversion by small machines may be taken at 75 per cent.; therefore, the power company could receive 0·98d. for unconverted high tension energy.

Suppose the transmission line from the power company's station to this borough to be required wholly for that supply and for no other. The cost of such overhead line would be about £2,900, allowing for a practical line with about 5 per cent. loss at full load. The company would, therefore, have to bear the following additional charges for distribution:—

| | | |
|---|---|---|
| Interest and renewals on line, say, ... | | £290 |
| Wayleaves for 91 poles ... ... | | 91 |
| £381, or 0·3d. per unit. | | |

Thus the remaining cost to the power company at their station switchboard would be 0·68d. per unit supplied to line. Owing to the local battery and the desire to there reduce wages at sub-station the load factor on the power station would be easily 25 per cent. or more. It would, therefore, pay the power company in this case. Indeed, most companies should be able to afford to supply at, say, £4 per KW., and 0·33d. for untransformed energy at the sub-station terminals. Therefore the price offered to the local borough would probably be (allowing for effect of battery)—

| | | |
|---|---|---|
| 150 KW. at £4 | ... | £600 |
| 310,000 units at 0·33d. | ... | 426 |
| £1,026 or 0·8d. per unit supplied. | | |

as against 0·98d. mentioned above, showing a saving to the local borough of £232 annually, or 20 per cent. In such a case (and indeed in probably most cases, where the local demand is under 500 KW.) it will be better to obtain the supply from the power company.

The local distribution can be well carried out by overhead wires. In small and compact boroughs, which are an exception, the mains can be laid underground, and will probably pay to be so laid. In sparser districts the mains must be run overhead, and poles can be dispensed with to a very great extent, and wayleaves obtained to attach small brackets and insulators to house fronts, thus minimising initial cost. This system has been in operation in the little village of Mevagissey, in Cornwall, for several years, with really excellent results and a surprising freedom from trouble.

The author's opinion is that, to deal with such districts, a low pressure of 100 volts or thereabout should be adopted, a few cables laid underground as feeders to one or two important points, and existing houses wired with flexible leads, if necessary, run through insulated eyebolts, thus making electrical supply practically cheap. The prejudice against fire risks, &c., usually following this type of wiring really exists mainly in the imagination, and is not borne out in practice.

The author calculates the cost of distribution in this example to be as follows (the sub-station being centrally situated):—

| | | |
|---|---|---|
| Two underground feeders laid solid ... ... ... | £2,475, say, £2,500. | |
| Five miles of overhead conductors, partly erected on poles, partly on house brackets, erected ... ... | | |
| Public lighting, 125 lamps (one-half being new and one-half taken as existing gas standards or brackets) ... ... ... ... ... ... | | |

The total cost, then, of production and distribution would be as follows:—

| | |
|---|---|
| 310,000 units high-tension energy supplied at a maximum demand of 150 kw. ... ... ... | £1,026 |
| Wages at sub-station ... ... | 260 |
| Management, general expenses, rating, &c., say ... ... ... | 815 |
| Capital charges on sub-station and distributing system ... ... | 445 |
| | £2,546, or 2·65d. per unit sold. |

The revenue account of such a business would be somewhat as follows:—

| | | |
|---|---|---|
| Private lighting, 97,500 units at 4d. ... ... | £1,625 | 0 |
| Small power users, 100,000 units at 2d. ... | 833 | 0 |
| Street lighting, 125 lamps at £2 5s. each ... | 281 | 5 |
| | £2,739 | 5 |

leaving a net balance of £193, or a gross profit to the borough of £445 + £193 = £638, representing practically 10 per cent. on the capital outlay of £6,650.

The average lighting consumer would pay about £5 a year for his lighting; the street lighting would be less than the present cost of gas; and the public would benefit by owning their own plant, from better conditions in their houses, and from having the energy available for small motors, when gas engines would be entirely out of the question. After all, such a condition of things already exists abroad, where tiny motors are used wholesale for all sorts and conditions of service.

Hundreds of such towns exist to-day in our country. Electricity is now no longer only at the service of the larger towns, and more compact areas; and the author looks forward to the not remote day when every such borough will have its electrical supply with all its concomitant advantages.

Can smaller districts than this example be so supplied? The author is sure they can, by the aid of the power companies' overhead transmission, and overhead distribution. The gist of this whole argument and example is, therefore:—

(*a*) Small districts must take the supply from an outside source when available, at reasonable rates, rather than install local generating plant.

(*b*) Facilities must be given to overhead transmission from the power station, which, no doubt, the power companies will take care to obtain.

(*c*) Facilities are imperatively necessary for overhead local distribution, as the only means for economical supply. Underground distribution would almost invariably put electricity "out of court" in competition with local gas supply.

(*d*) The fire insurance companies must be induced to show encouragement to householders to enable surface wiring, as described above, to be adopted at the low pressure named.

The removal of the prejudice against such systems would increase and multiply the use of electrical energy, and make its adoption by small districts practicable and commercially possible.

The author has not dealt with a supply by alternating current. Three-phase transmission is almost universally in operation, and the advantages of a local battery as stand-by and a means of improving load factor are so apparent, coupled to the sweet simplicity of a low pressure two-wire local overhead transmission, that this latter system will be found hard to beat.

### Discussion.

Mr. A. B. Mountain criticised the estimate of revenue. The author assumed a consumption of 70 units per head of population, but in Sunderland the consumption was only 21 units per head, excluding tramway load. Also, 13 units per lamp per annum was too high an estimate, and he thought that from 8 to 9 units was a more likely figure for the first three or four years. From his experience in small towns he would expect an income of about £800, where Mr. Snell had estimated nearly £3,000. It was impossible to get large revenues in small towns and villages. He thought a supply might be made to pay by adopting a gas plant and running it at night only, so giving an intermittent supply. If power were taken from a large company, he would prefer to distribute alternating current and reduce the cost of a sub-station to nearly £500.

Mr. L. Andrews stated that there were 1,300 towns and villages in the United Kingdom with over 3,000 inhabitants which had not yet any electric supply. The author showed 20 per cent. profit on a 7-mile transmission; if the current had to be taken 10 miles the profit vanished. He advocated the use of producer-gas plants for such work, and quoted figures from the trials of suction producers in Scotland.

Mr. H. B. Maxwell, of Partick, had had experience in a town of 10,000 inhabitants, where the total income of the gas undertaking was considerably less than Mr. Snell assumed for a borough with 3,400 inhabitants. There was no reason for converting into direct current. A static transformer sub-station, including a voltage regulator, could be equipped for £800. He thought that, if power companies would use 50-period frequency, a large proportion of sub-station costs would be saved, and also labour in working.

Mr. C. C. Atchison considered that a gas or oil plant would be more suitable for a small supply.

Mr. Berry, of transformer fame, advocated the supply of alternating current to consumers, so as to avoid the capital and running charges involved in conversion. To make such a scheme pay, electricity must be supplied very cheaply. At 1d. per unit it was as economical to cook with electricity as with gas at 3s. per 1,000. Any higher charge, however, would probably stop this possible demand.

Mr. G. Wilkinson, of Harrogate, believed in having local stations for supply in small areas. He had had successful results with internal combustion engines for such work. It was quite necessary to employ overhead distribution.

Mr. J. F. C. Snell, whose reply certainly did not convince his critics, said the consumption in Sunderland was 28 units per head, and at Brighton 70 units per head. In estimating the revenue he had taken what he considered to be the correct figures when the undertaking had been properly established and developed. There was a great source of income from small power consumers.

## RAPID METHODS FOR PRODUCING ELECTROTYPES.

By SHERARD COWPER-COLES.

(*Concluded from page* 36.)

*Class 5.—Electrolyte Circulated and Filtered.*—The electrolyte can be readily filtered in all cases where the solution is circulated by placing a filter outside the depositing vat.

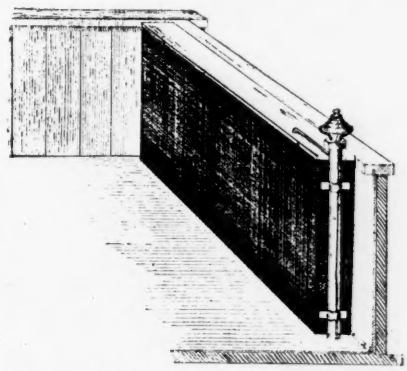


Fig. 34.—Filter Frame Fitted with Pump.

Fig. 34 shows an arrangement that can be readily placed in any depositing vat; it consists of a wooden frame, covered with filtering cloth. A small white-metal pump is attached to the frame, which can be worked by hand, or by an electric

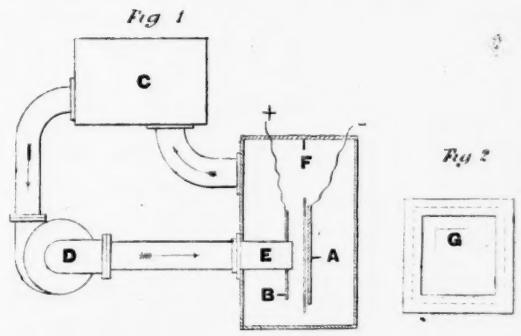



Fig. 35.—Graham's Apparatus.

motor; the solution is pumped from the bottom of the vat into the top of the filter, and allowed to percolate through the filtering medium by gravity. The top of the filter frame is removable, to allow the sludge to be withdrawn.

*Class 6.—Impingement Process.*—Graham patented an apparatus in 1896, in which the electrolyte is discharged on to flat cathode surface by means of jets from circular orifices (fig. 35). The copper anodes B, which have surfaces eight or nine times greater than that upon which the deposit is to take place, are in spiral, grid-like or corrugated form. The edges of the cathode are protected by a shield of vulcanite standing a short distance from the cathode, to prevent irregular deposits on the edges. A nearly saturated solution of copper sulphate, containing 5 oz. (141·75 grms.) of strong sulphuric acid per cubic foot (28·31 c.dcm.) of water, is used as electrolyte, and is stored in reservoirs placed from 1 to 2 ft. (30·48 to 60·96 cm.) above the electrolytic vat; thence it is conveyed to $\frac{3}{8}$ in. (0·95 cm.) jets that deliver it in a stream upon the surface of the cathodes, which are placed at a distance of 1 in. (2·54 cm.) from the orifices of the jets. It is stated that a current of 300 amperes per square foot (9·29 sq.dcm.) may be employed with safety at all points within the sphere of influence of the jets; beyond this area it is obvious that the deposit would be pulverulent and useless. The radius of the protected area was found to be 5 in. (12·7 cm.), so the number and disposition of jets employed must be arranged accordingly.

Poore, in 1896, obtained a patent for an apparatus for depositing metals, as shown in fig. 36. The solution is sprayed, or otherwise delivered, over the cathode plate A, which is the electrotype, and thus the stream or jet forms the only connection between the anode and the cathode,

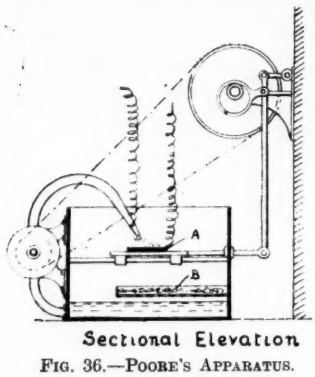



Fig. 36.—Poore's Apparatus.

which necessitates the employment of a comparatively high-voltage dynamo. The cathode is agitated by the table (upon which it is mounted), being moved to and fro by the eccentric arrangement shown in the illustration. On the tray B, is placed the required salt to bring the electrolyte up to strength for re-use. The drawback to all impingement

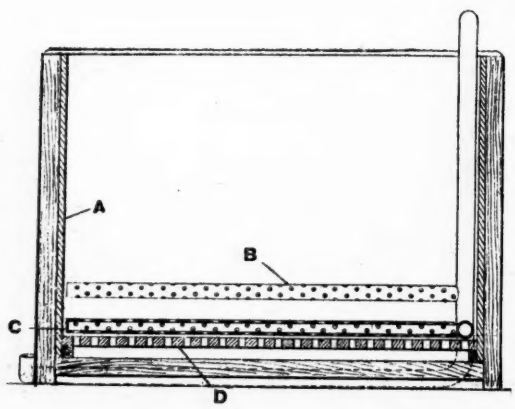



Fig. 37.—Hopkinson and Appleton's Agitator.

processes is that the amount of electrolyte to be pumped is very large, and unless the cathode is moved at a considerable rate, the copper varies very much in texture.

*Class 7.—Air Agitation.*—If air is not used for circulating or agitating the solutions, some other arrangement should be provided for bringing it into intimate contact with the air, so as to convert the cuprous sulphate into cupric sulphate, which is essential to good deposits of copper; the air also oxidises the impurities in solution, causing them to separate out.

Fig. 37 shows an apparatus in which the electrolyte is circulated and agitated by air forced through the perforated pipes B; the apparatus was patented by Hopkinson and Appleton in 1889.

Fig. 38 shows a compact air compressor made by Messrs. Penrose, driven by an electric motor; the pump is a

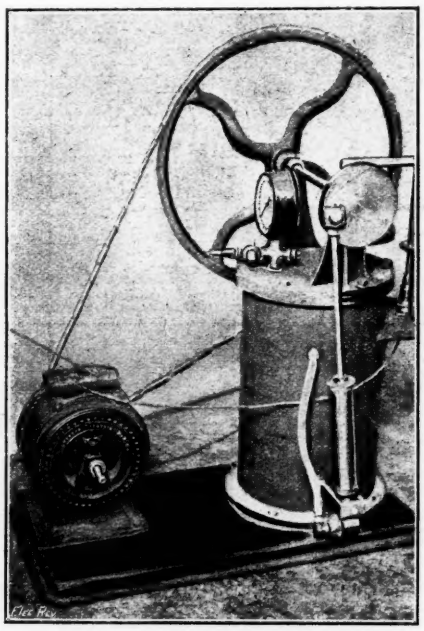


Fig. 38.—Penrose's Air Compressor.

reciprocating one, so as to economise space. Fig. 39 shows another form of compressor. In both cases the air receiver is larger than necessary, as it is not desirable to have

Fig. 39.—The Ostrander Air Compressor.

a continuous flow of air; an intermittent supply is as good as, if not preferable to, a continuous supply.

In the Leetham apparatus, fig. 40, the agitation is effected by air compressed in a reservoir by a small double-acting pump. The air is forced into the bath through perforated lead pipes, which lie on the bottom of the vats, and the pressure is regulated by valves, so that the agitation may be made more or less violent. On the top of the receiver, and connected with it, is a condensing chamber provided with

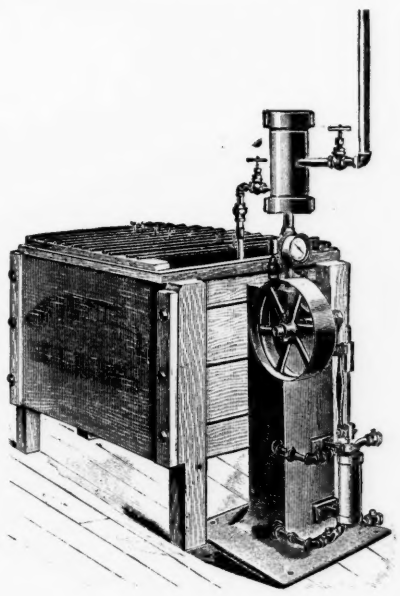


Fig. 40.—Leetham Apparatus.

an outlet for steam, through which the air passes before it is admitted to the vat. When it is desired to increase the temperature of the bath, or increase its contents, steam is admitted to the chamber, where it is condensed, and it is then conveyed to the solution through the air pipes. This device, therefore, provides means for heating the solution and supplying it with distilled water, as well as agitating it.

*Conclusion.*—The types of apparatus employed for circulating and agitating the solution, also for aeration, are numerous, as will be gathered from the foregoing remarks; but if they do not provide the conditions necessary for keeping the solution in the cupric state they are useless, except for slow electrotyping.

It is also necessary that the composition of the electrolyte be kept constant as well as the temperature, and that the mould be of metal, so as not to be acted on by the hot electrolyte. The process of the future is no doubt one that combines a metallic mould with a very high rate of deposition, and the necessary provisions for keeping the electrolyte in the best working conditions, as such a process reduces the labour considerably, doing away with no fewer than three operations—namely, the filling of the case with wax, the coating of the wax mould with plumbago, and the re-melting of the wax after use.

**A New Method of Insulating Copper Wire.**—A cheap and effective method of insulating conductors for use in house wiring and other purposes is described by the *Elektrotechniker*. The surface of the copper is first treated by passing it through a solution of proto-sulphide of potassium, and so exposing it to the action of sulphuretted hydrogen vapour. When the copper has attained a bluish-black tinge, it is exposed to the air until it becomes quite black, and finally it is well washed in water. When dry, it is only necessary to coat the wire with a suitable varnish made of good linseed oil; to do this the wire is drawn through a bath of the melted varnish, and dried. The resulting covering is perfectly continuous and impervious to moisture, and its flexibility, though not so great as that of gutta-percha, is ample for ordinary purposes. The price of the linseed oil varnish varies from about £1 to £2 per cwt., according to the formative process to which it is subjected.

## INTERFERENCE IN WIRELESS TELEGRAPHY AND THE INTERNATIONAL TELEGRAPH CONFERENCE.

By R. A. Fessenden.

(*Continued from page* 40.)

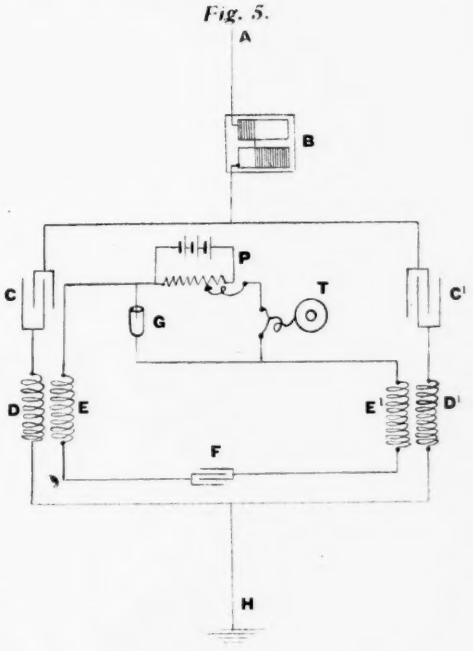
Selectivity by Balance Methods.

As soon as it was realised that selectivity could not be obtained by resonance, and that circuits could never be coupled loosely enough to give really sharp tuning without at the same time becoming inefficient radiators and absorbers, other methods were developed. One of the earliest methods is shown in fig. 5. Here A is the antenna, B is a variable inductance, C and $C^1$ are variable capacities, D and $D^1$ are primaries and E $E^1$ secondaries of an Elihu Thomson or air-core transformer, F is a variable condenser, and G a liquid barretter, T a telephone, and P a potentiometer. The aerial is grounded or connected to a wave-chute at H.

In this device the primaries D $D^1$ are similar, and so also are the secondaries E $E^1$. The secondaries are connected up so as to oppose each other. In practice the circuit A, B, C, D, H is tuned so as to be resonant to the frequency which it is desired to receive, the other circuit being disconnected while this is being done. The circuit A, B, $C^1$, $D^1$, H is then closed, and the variable condenser $C^1$ tuned until disturbing signals are cut out.

The capacity $C^1$ will, as a rule, be about 5 per cent. different from the capacity C. When the difference between the wave-lengths of the sending station and interfering station is more than 3 per cent., and the stations are of equal strength and at the same distance, the signals will be

*Fig. 5.*




strengthened by the interference preventer. When the difference in wave-length is about 1 per cent., the signals will be neither increased nor decreased. When the difference of wave-length is a quarter of 1 per cent., the signals will be weakened about one-half. These figures, of course, depend upon the construction of the interference preventer, but I am speaking of the interference preventer as actually constructed and used.

The operation will be at once understood. When the desired frequency is received, it passes almost entirely through the side A, B, C, D, H, and affects the receiver. A frequency different from the one it is desired to receive, can always be made to divide itself equally between the two

branches, and as the secondaries oppose each other, there will be no effect on the receiver. There are some complicated questions of phase, capacity between primary and secondary, &c., which I will not go into now. Moreover, when there are a great number of interfering stations, it sometimes pays to use four divided circuits, two in tune with the frequency which it is desired to receive, and one above and one below that frequency.

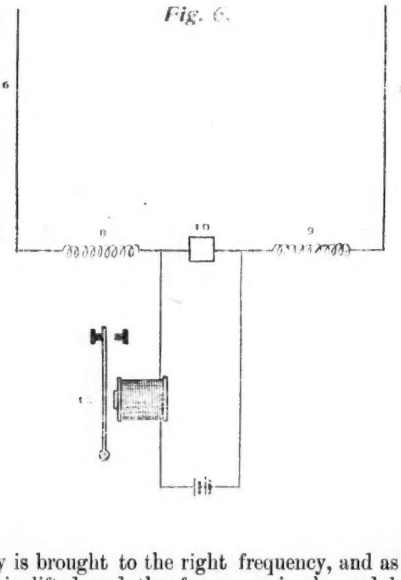
One of the earlier forms is shown in fig. 6, taken from U.S. patent No. 706,740, filed September 28th, 1901, and there are other later developments, which I cannot publish at the present time.

In fig. 7 is shown a transmitting apparatus, called a secrecy sender, which is adapted to be used with the interference preventer shown in fig. 5. From inspection of this figure it will be seen that the signals are produced by varying the frequency, while the oscillations are being generated continuously. In practice it is found that when the depression of the key produces a variation of $\frac{1}{4}$ per cent., this is amply sufficient for all practical work, and, in fact, a difference of $\frac{1}{8}$ per cent. has been used.

The advantage of this apparatus is, as illustrated in figs. 8, 9 and 10, that any station in the neighbourhood which is not tuned to the exact frequency receives a continuous indication. If the signals are received on a telephone it gives a continuous hum, or if they be recorded, the needle of the recorder is pulled steadily to one side by a certain amount. The station, however, hears no signals, and since the disturbance produced is a uniform one it has no difficulty in reading messages from its own stations.

On the other hand, the station which is receiving the signals hears the signals when the key is depressed and the

*Fig. 6.*



frequency is brought to the right frequency, and as soon as the key is lifted and the frequency is changed by $\frac{1}{4}$ per cent. it does not hear the signals at all.

Practical experience has shown that the combination of the secrecy sender and interference preventer furnishes a means of working practically any number of stations in proximity to each other without interference. This system is now two or three years old, and has had an extended test in practical working. After it had been in use for three months at a New York station, inquiries made of the operators of the stations in that neighbourhood developed the fact that none of them were aware that messages were being sent, all thinking the operator using the secrecy sender had merely been making very prolonged dashes for testing purposes.

In actual operation, the change of frequency is not made by the use of a key *e*, but by short-circuiting and open-circuiting a single turn *f* placed in proximity to the sending inductance or Elihu Thomson transformer; *f* is a sending typewriter, which operates the magnet *s*. Normally the single turn *f* is held by a spring in a short-circuited position, in accordance with the letter sent, and so annuls about one-half of 1 per cent. of the inductance of the sending inductance *n*, thus throwing the frequency about a quarter of 1 per cent. out of tune. If a key of the typewriter *f* be depressed, the electro-magnet *s* is energised and operates to close and open the contact *v*, and to so change the frequency

*Fig. 7.*

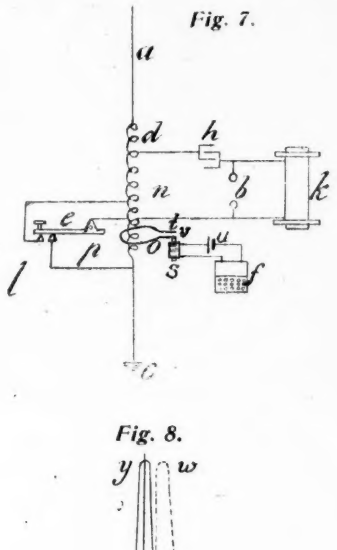



*Fig. 8.*

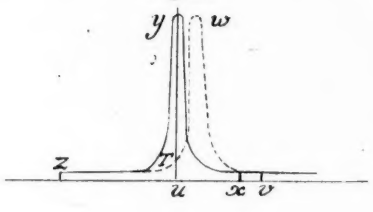



*Fig. 9.*

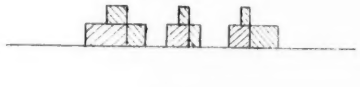
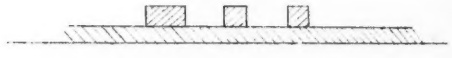


*Fig. 10.*



of the waves corresponding to the Morse equivalent of the key depressed.

This method is also used with a discharge frequency above the limit of audibility.

(*To be continued.*)

**Westinghouse Enterprise in Russia.**—It is reported from Moscow that the works of the Compagnie Centrale d'Electricité in that city have passed into the possession of the Russian Westinghouse Co. for the sum of £400,000. Should the report prove to be correct, the latter company would in this way enter the ranks of the important firms engaged in electrical manufacturing in Russia, as the works of the Belgian Compagnie Centrale represent the sole establishment which comes into consideration in conjunction with those of the large German firms, such as the Siemens & Halske Co., the Allgemeine Co. and the former Union Co., which is now amalgamated with the Allgemeine Co. The new owner of the Belgian works will become a serious competitor of the German firms, especially as the Westinghouse Co. has already secured the contract for the conversion of the St. Petersburg tramways to electric traction, and has just started the preliminary operations. This fact has stimulated the company's desire to own works for the construction of electrical machinery, as the proposed factory in St. Petersburg has not been established. The company, which has a share capital of £300,000, has distributed dividends in the past three years, but no information is forthcoming as to the method in which it is intended to pay for the purchase of the Belgian works. The Compagnie Centrale was formed in 1896, and has not worked with favourable results in recent years. At present the company, with a combined share and bond capital of £675,000, has a deficit of £67,500, and over £300,000 book debts. It is not obvious from the balance-sheet as to the amount at which the works are valued or booked, but it is in any case concluded that a liquidation would result in a considerable loss. The report of the Russian Siemens & Halske Co., in referring to the Westinghouse Co.'s success in regard to the first section of the St. Petersburg tramways, states that the contract was accepted at a price which rendered competition impossible.

## ELECTRICAL ENGINEERING AND RAILWAY LABORATORIES AT WORCESTER POLYTECHNIC INSTITUTE.

THE contract has just been let by the trustees of Worcester (U.S.A.) Polytechnic Institute for the erection of a new electrical engineering building, at a cost of approximately $125,000.00. A plan of the building is shown herewith, from which may be seen that the electrical engineering and railway laboratories will undoubtedly be larger than those of any other college in the world, the building being 200 ft. in length and over 100 ft. in width, and three stories high. The floor space available for laboratories comprises over half an acre, and when the building is ready for use early next year, it is claimed that it will contain not only the largest but perhaps the best-equipped college laboratory in existence.

A description of some of its features may be of interest.

Numerous lecture rooms, offices, laboratories, &c., are provided, and in the westerly wing is located the standards laboratory, where standard reference instruments and apparatus will be found, and where the more exact work of calibration and standardisation will be conducted.

On the accompanying first floor plan there will be seen three features of primary importance:—

(*a*) The large general laboratory, having a length of 200 ft. and width of 55 ft., containing with three galleries a floor area of 19,400 sq. ft. and a volume of about 400,000 cb. ft. (nearly 100,000,000 cb. ft. for the entire building), constitutes what is, undoubtedly, the largest electrical engineering laboratory in the world.

This laboratory is served by a 10-ton electric travelling crane covering the whole of the central portion of the laboratory between the galleries.

On this main floor-space under the crane, will be fixed all the heavier pieces of equipment.

(*b*) In the west wing of the building is located the lecture hall, which is capable of comfortably seating 300 persons. There is a difference in level of 8 ft. from front to back of the room, so that a good view of the demonstration table is obtainable from every seat. Behind the demonstration table is a switchboard controlling circuits reaching any of the equipment of the department, and the power units of the power laboratory. An overhead trolley hoist will take apparatus from the crane in the general laboratory to the demonstration table. Facilities for darkening the room and for the projection of lantern views will be provided.

(*c*) In the east wing is located the department library and reading room, which will have shelf room for 3,000 volumes.

Upon the upper floor of the building, in the west wing, is the large high pressure and insulation laboratory, where are located the high pressure transformers, permitting the use of voltages of any desired frequency and any value up to 750,000 volts, for the study of the various problems of long-distance high pressure power transmission, and the dielectric and electrostatic characteristics of insulating and other material. It is proposed to develop this work on a most comprehensive scale, the Institute being a pioneer among the colleges in the study of very high potential phenomena, as well as a pioneer in the establishment of a chair of electric railway engineering, and in the provision of extensive facilities for both of these lines of work.

Returning to the large general laboratory, the galleries are designed to accommodate the lighter and accessory laboratory equipment, such as the switch signal, air-brake and controller apparatus for the electric railway work, the arc lighting apparatus, transformer and all other equipments not having heavy rotating or reciprocating parts. These galleries are served by 2-ton trolley travellers, arranged to connect with the 10-ton travelling crane serving the main floor.

The workshop will be equipped with motor and machine tools necessary for ordinary maintenance and repair of equipment and the building of such special equipment for the laboratories as can be undertaken advantageously, and the instrument room will contain the general supply of portable instruments for common use in the laboratories. In the diagram are indicated by numbers some of the larger pieces of stationary apparatus on the main floor. Nos. 2, 3, 4, 5 and 6 are induction motor-driven generators for direct and alternating current of various voltages, frequencies and phases for general laboratory supply. No. 7 is a 300-H.P. synchronous motor driving a double-current generator delivering 500 volts D.C. and 350 volts 25 cycles single-phase A.C. for the railway laboratory. The motors driving all these generators receive their supply from the Institute service power plant, which is in a separate building and of ample capacity. The supply circuits from the service plant terminate in the switchboard on the main laboratory floor, shown on the plan, and from the switchboard are operated all the above mentioned motors and generators, as well as the supply circuits to other portions of the laboratory and tie-in circuits to other switchboards in the lecture room and high-pressure laboratory.

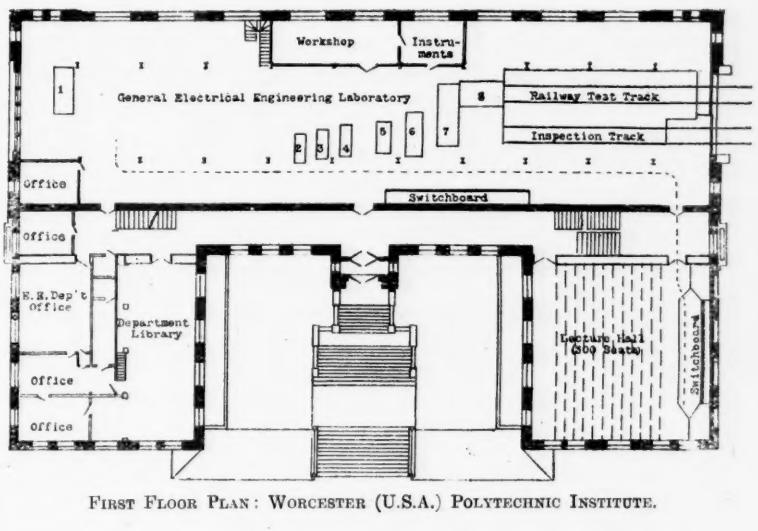
Two tracks enter on the main floor of the laboratory under the travelling crane, one of these tracks being over an inspection pit, the other terminating in a testing stand, of which the following are the principal features:—

Supporting wheels with steel tires of the same section as the top of an American standard 100-lb. rail are mounted to standard gauge on axles, supported by pedestals arranged so that they can be moved to come directly under the wheels of a car of any wheel or truck base.

Separately excited direct-current generators are mounted on the pedestal frames and geared to the supporting axles, with rheostats for load, these generators also keeping the two or four axles which may be in use in synchronous rotation.

Fly-weeels are mounted on the supporting axles, of the proper weight to produce the inertia effects which would be due to the weight of the car in ordinary motion on level track. These fly-wheels are arranged so that their weight may be changed, to provide for the testing of cars of various weights.

A traction dynamometer holds the car stationary over the supporting wheels, and measures the drawbar pull exerted by it, whether due to the action of its motors in acceleration or to its brakes in retardation.




FIRST FLOOR PLAN: WORCESTER (U.S.A.) POLYTECHNIC INSTITUTE.

This testing stand will accommodate any standard gauge car up to 60 ft. in length, and the testing apparatus will be of sufficient capacity to deal with such motors and weights as may be found on cars up to that size.

Another important feature of the railway laboratory equipment will be a double-truck four-motor car, 45 ft. in length, weighing about 25 tons, and equipped with four 50-H.P. motors. It is the intention to provide a duplicate set of trucks for this car, one set equipped with D.C. motors, and the other with A.C. motors. This car will be provided with special recording instruments for indicating speed, current, voltage, air pressure, &c., as well as the various electrical and physical conditions of the track passed over, and may be operated either upon the test track in the laboratory or over the lines of any of the New England railways, which may be reached through a connection to the laboratory with the tracks of the local street railway company.

Besides the apparatus with which the test car is equipped, the laboratory equipment will include representations of various manufacturers' different systems of controlling and braking apparatus, and arrangements will be made so that the test car while operating on the testing stand may be controlled by any of the forms of automatic or hand control situated alongside the test track. The various systems of signalling will be shown in operation in one of the galleries, where examples of current practice in overhead and third rail construction and bonding will also be found.

Apart from the unexcelled facilities for instruction which this laboratory will afford, its location at Worcester, in the heart of New England, and its rail connection with the New England railways, making available the use of its testing facilities for any car or of its testing car for any road, should be of great advantage to these roads.

We are indebted to the courtesy of Assistant Prof. A. S. Richey, B.M.E., of the Worcester Polytechnic Institute, for the foregoing particulars.

---

**Stolen Cable.**—Two young men were recently sent for trial at Dublin on a charge of having stolen a quantity of copper cable, the property of the Dublin United Tramways Co. The larceny was alleged to have been committed at Howth Road; it was stated that great damage had been done to a portion of the electric system at the place mentioned, and that it must have been done at night, when no current was passing.

half of 1 per cent. of the inductance of the sending inductance $n$, thus throwing the frequency about a quarter of

tramways, states that the contract was accepted at a price which rendered competition impossible.



## NEW PATENTS APPLIED FOR.

**Compiled expressly for this journal by W. P. THOMPSON & Co., Electrical Patent Agents, 322, High Holborn, London, W.C., and at Liverpool, to whom all inquiries should be addressed.**

14,226. "Improvements in and relating to electrically-propelled road vehicles." C. Mildé. June 21st.

14,259. "Electric plant for producing chemical reactions." I. MOSCICKI. (Date applied for under Patents Act, 1901, January 17th, 1906, being date of application in Germany.) June 21st. (Complete.)

14,289. "Improvements in conduit fittings for electric wires and cables." OLDBURY STEEL CONDUITS, LTD., and J. SUTTON. June 22nd.

14,342. "Improvements in prepayment mechanism for electric and other meters." J. ALLAN. June 22nd.

14,501. "Improvements in dynamo-electric machines." V. A. FYNN. June 25th.

14,511. "Improvements in controllers suitable for electro-motors." J. SCHUIL and A. C. REYROLLE. June 25th.

14,517. "Improvements in magnetic clutches." H. W. RAVENSHAW, V. G. MIDDLETON and W. E. TOWNSEND. June 25th.

14,577. "Improvements in electric circuit-breakers or makers." J. G. STATTER. June 26th.

14,589. "Improvements in or relating to electric switch apparatus." G. C. FRICKER. June 26th.

14,590. "Improvements in or relating to selecting switch mechanism suitable for advertising, signalling and like purposes." G. C. FRICKER. June 26th.

14,592. "Improvements in electrical indicating apparatus." G. W. HARRIS. June 26th.

14,608. "Improvements in electric arc lamps." J. BROCKIE. June 26th.

14,611. "Improvements in electric conductor mouldings." S. M. BURK. June 26th. (Complete.)

14,614. "Improvements in or relating to electric clocks." H. J. HADDAN. (Kutnow Bros., United States.) June 26th. (Complete.)

14,615. "Improvements relating to electric railways working on the surface contact system." E. ROTHWELL. June 26th. (Complete.)

14,636. "Improvements in devices for moving electrically the points on electric tramways and railways." J. P. TIERNEY and J. MALONE. June 27th.

14,642. "Improvements in secret keyboard for central exchange switchboard." R. M. BEARD. June 27th. (Complete.)

14,668. "Improved electro-synthetic process, and apparatus employed therein." J. TANNE and E. PAPENBRUCH. June 27th.

14,684. "Improvements in electrical apparatus for calibrating measuring instruments for alternating currents." SIEMENS BROS. & Co., LTD. (Siemens and Halske Akt.-Ges., Germany.) June 27th. (Complete.)

14,689. "Improvements relating to the control of electrically-operated signalling systems for railways and the like." H. G. BROWN. June 27th.

14,695. "Improvements in and relating to power-generating systems." THE BRITISH THOMSON-HOUSTON CO., LTD. (General Electric Co., United States.) June 27th.

14,696. "Improvements in a single-phase alternating-current series motor." M. LATOUR. (Date applied for under Patents Act, 1901, June 28th, 1905, being date of application in France.) June 27th. (Complete.)

14,697. "Improvements in and relating to dynamo-electric machines." M. LATOUR. (Date applied for under Patents Act, 1901, June 28th, 1905, being date of application in France.) June 27th. (Complete.)

14,705. "Improvements i electric arc lamps." F. M. LEWIS. June 27th.

14,712. "Improvements in continuous or alternating-current electrical machines with commutating poles." E. ARNOLD. (Date applied for under Patents Act, 1901, October 20th, 1905, being date of application in Germany.) June 27th. (Complete.)

14,720. "Improvements in magneto electric generators." W. B. A. SPRAY. June 28th.

14,737. "Improvements in magneto-electric generators." ALBION MOTOR-CAR CO., LTD., and T. B. MURRAY. June 28th.

14,780. "Improvements in medical apparatus for administering three-phase sinusoidal currents." A. LLOYD. June 28th.

14,787. "Improvements in lightning arresters." THE BRITISH THOMSON-HOUSTON CO., LTD. (General Electric Co., United States.) June 28th.

14,788. "Improvements in electric current-collecting devices." THE BRITISH THOMSON-HOUSTON CO., LTD. (General Electric Co., United States.) June 28th.

14,789. "Improvements in and relating to electric distribution systems." THE BRITISH THOMSON-HOUSTON CO., LTD. (General Electric Co., United States.) June 28th.

14,792. "Improvements in electro-magnetic relays." P. O. PEDERSEN. (Date applied for under Patents Act, 1901, July 4th, 1905, being date of application in Denmark.) June 28th. (Complete.)

14,803. "Improved method of and means or apparatus for the electric deposition of metals or alloys." J. H. S. BRADLEY, H. C. POWELL, P. DONALDSON and C. H. WINGFIELD. June 28th.

14,804. "Improvements in or relating to telephonic exchange switchboards." E. A. GRAHAM. June 28th.

14,809. "Improvements in electric arc lamps." W. J. DAVY. June 28th.

14,816. "Improved method of producing metallic incandescence bodies for electric glow lamp." DEUTSCHE GASGLUHLICHT AKTIENGES. (Auergesellschaft.) (Date applied for under Patents Act, 1901, October 28th, 1905, being date of application in Germany.) June 28th. (Complete.)

14,828. "Improvements in the control of electric motors." J. G. WILSON. June 30th.

14,839. "Improvements in bayonet caps for electric glow lamps." G. DAVIS. June 30th.

14,840. "Improved magnetic apparatus for the separation of ores in the wet state." E. M. T. BODDAM and L. S. BURT. June 30th.

14,851. "Automatic distribution of the operating service in telephone exchanges." KJOBENHAVNS TELEFON-AKTIESELSKAB. (Date applied for under Patents Act 1901, June 30th, 1905, being date of application in Germany.) June 30th. (Complete.)

14,901. "Improved method of producing metallic electrical incandescence bodies." DEUTSCHE GASGLUHLICHT AKTIENGES. (Auergesellschaft.) (Date applied for under Patents Act, 1901, October 28th, 1905, being date of application in Germany.) June 30th. (Complete.)

14,910. "Improved junction box for electric cables." T. B. READER. June 30th. (Complete.)

14,911. "Improvements in joint boxes and the like for telegraphic and other electrical cables." D. BOULD. June 30th.

14,922. "Improvements in electrolytic diaphragms." I. L. ROBERTS. June 30th. (Complete.)

14,925. "Improvements relating to electric cells and the like." R. E. WELLARD. June 30th.

14,935. "Improvements in and relating to dynamo-electric machines." ALLGEMEINE ELEKTRICITATS-GES. (Date applied for under Patents Act, 1901, June 30th, 1905, being date of application in Germany.) June 30th. (Complete.)

14,936. "Improvements in control of alternating current motors." THE BRITISH THOMSON-HOUSTON CO., LTD. (The General Electric Co., United States.) June 30th.

14,939. "Improvements in self-registering electrically-operated targets." G. A. PETERS. June 30th.

14,945. "Improvements in electric starting machines having fly-wheels that can be uncoupled therefrom when working with light loads." SIEMENS BROS. DYNAMO WORKS, LTD. (Siemens-Schuckertwerke G.m.b.H., Germany.) June 30th. (Complete.)

## PUBLISHED SPECIFICATIONS.

**Copies of any of these Specifications may be obtained of Messrs. W. P. THOMPSON & Co., 322, High Holborn, W.C., and at Liverpool, price, post free, 9d. (in stamps).**

### 1905.

ELECTRIC CONDUCTORS. A. G. Betts. 12,880. June 22nd.

TELEPHONE (R LIKE TRANSMITTERS. J. S. Sawrey. 13,228. June 27th.

APPARATUS OR APPLIANCE FOR MORE READILY ADJUSTING THE TROLLEY WHEEL OR ARM OF ELECTRIC CARS TO THE OVERHEAD WIRES. T. F. Stidolph. 13,779. July 4th.

METHOD OF MAKING RESISTANCES SPECIALLY ADAPTED FOR USE IN CONNECTION WITH ELECTRICALLY HEATED CURLING TONGS AND SUCH LIKE. J. Maclean. 14,167. July 10th.

DYNAMO-ELECTRIC MACHINES. British Thomson-Houston Co. (General Electric Co.) 16,304. August 10th.

ELECTRICALLY CONTROLLED CIRCUIT BREAKER. E. Turner. 16,324. August 11th.

AUTOMATIC REGULATORS OR RHEOSTATS FOR ELECTRIC CURRENTS. P. Kennedy. 17,314. August 26th. (Date applied for under International Convention, November 12th, 1904.)

ELECTRICAL GENERATOR SYSTEM FOR USE IN CONNECTION WITH AUTOMOBILES AND THE LIKE. Electric Ignition Co. and F. H. Hall. 17,897. September 5th.

COMBINED AUTOMATIC ADJUSTING APPARATUS AND LUBRICATING AXLE FOR USE ON TROLLEY HEADS OF ELECTRIC CARS AND THE LIKE. H. Niblett. 11,852. September 18th.

SYSTEMS FOR THE TRANSMISSION OF ALTERNATING AND PULSATING ELECTRIC CURRENTS. I. Kitsee. 20,547. October 11th.

SMALL INDUCTION COILS WORKED FROM STREET ELECTRIC LIGHT MAINS. L. B. Miller. 22,317. November 1st.

### 1906.

SPARKING PLUGS FOR INTERNAL COMBUSTION ENGINES. J. Sehuiniol. 1,785. January 24th.

ARC LAMPS. T. L. Carbone. 4,343. February 22nd. (Date applied for unde International Convention, February 27th, 1905.)

VENTILATION OF DYNAMO-ELECTRIC MACHINES. E. M. Tingley. 5,853. March 10th. (Date applied for under International Convention, March 17th, 1905.)

VAPOUR-ELECTRIC APPARATUS FOR CONVERTING OR INTERRUPTING ELECTRIC CURRENTS AND OTHER PURPOSES. P. C. Hewitt. 6,559. March 19th. (Date applied for under International Convention, March 29th, 1905.)

ELECTRIC CONDENSERS SUITABLE FOR USE IN WIRELESS TELEGRAPHY AND OTHER PURPOSES. Soc. Anon. des Manufactures de Glaces et Produits Chimiques de St. Gobain Chauny et Cirey. 7,292. March 26th. (Date applied for under International Convention, April 6th, 1905.)

**Niagara Power.**—A correspondent at Ottawa writes: "It is a little difficult to see that the agitation maintained by the United States for the preservation of Niagara Falls is fairly and honestly based. The measure, which proposes to regulate the control of the waters as far as American jurisdiction extends, is now before the United States Congress, and has reached the stage in which it will go substantially to President Roosevelt for his signature. Since its introduction last April it has been appreciably modified. It originally contained a provision limiting the quantity of water which might be taken from Lake Michigan for the Chicago Drainage Canal to 10,000 cb. ft. a second—the amount now withdrawn. This has been eliminated, and no restriction is put on the use of water for sanitary purposes or for navigation. In other words, nothing contained in the Bill will interfere with the transformation of the drainage canal into a ship canal. The law is made applicable only to power companies. These are permitted to make drafts sufficient to develop not more than 350,000 H.P. They are not using nearly so much just now, but according to the last report of the American section of the Waterways Commission, a total consumption which is equivalent to 342,000 H.P. has been authorised by State charters. The importation of electric power from Canada is not prohibited, as was once proposed, and the period at the end of which the law becomes invalid if a treaty with Great Britain is not in the meantime negotiated, is fixed at three years, instead of two, as the Waterways Commission advised."

**German Enterprise in Corea.**—A letter from Seoul refers in glowing terms to the development of Chemulpo, the most important commercial centre on the west coast of Corea, especially since the late war. The locality is described as now being a Japanese town, the council of which numbers among its members the foreign merchants who have settled there. As the desire for the introduction of the electric light became general a competition was opened, with the result that the German firm of C. Meyer & Co. secured the contract. The central station, which was started in April, contains two boilers made by the firm of Steinmuller, of Gummersbach, and having a steam pressure of 158 lb., and fitted with superheaters; two horizontal tandem engines, each of 175 H.P., made by the firm of Ph. Swiderski, of Leipzig; and two direct current dynamos supplied by the Siemens-Schuckert Works Co. The station is in the hands of the Chemulpo Electricity Co., and the wiring of premises is being carried out by Japanese. About 500 glow lamps were connected at the middle of April.